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ABSTRACT

This program for the 1996 Association for Learning Technology Conference summarizes the poster sessions, discussions, workshops, and software demonstrations, and provides abstracts of the 38 papers presented. Topics covered by the papers include: hand-held technology for mathematics; modeling global warming; computer-mediated communications; Java; computer-assisted learning for medical students; learning strategy in a computer-mediated environment; effectiveness of multimedia learning; simulations; impact of technology on education; plans for an international electronically-supported master's degree; multimedia applications; integration of technology into teaching and assessment; computer therapy for algebra-phobics; coping with diversity; cross-curricular information technology tools; the World Wide Web in academia; computer-mediated communication in distance tutoring; a media selection support system; systems-based framework for integrating technology; learning diaries and technology; multimedia motion and motivation; learning mathematics using computers; integrative evaluation as a change agent; technology in a medical undergraduate curriculum; technology in biology, business studies, and humanities; electronic questionnaires; environments for active learning; enriched distance learning and independent study; re-skilling of a distance teacher; computer-mediated communication in a women's studies course; effectiveness and limitations of language learning; advising in open and distance learning; technology in the language curriculum; and building an institutional information environment. (MES)

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ED 416 836

ALT-C 96

Integrating technology into the curriculum

Monday 16 September to
Wednesday 18 September

Glasgow, Scotland, UK

jointly hosted by

Glasgow Caledonian University
University of Glasgow
University of Strathclyde

CONFERENCE PROGRAMME
and
ABSTRACTS

ALT

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CONFERENCE PROGRAMME and ABSTRACTS

ALT-C 96

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From left to right: ***Tom King, Gabriel Jacobs, Adrian Bowman, Jonathan Darby, David Hawridge, Rick Trainor, Val Belton, Joan Kemp, April Kirkwood, Shona Cameron***

WELCOME

Welcome to the third annual conference of the Association for Learning Technology (ALT). Over the past three years the size of the conference has grown considerably and this year we expect record numbers to be attending the event in Glasgow. From the programme and abstracts in this booklet the breadth and depth of current research and development in learning technologies are apparent.

The ALT conference is an excellent opportunity for us all to take stock of where these developments have reached, and where they are leading. Our three plenary speakers are particularly well placed to assess the current state of learning technologies and to describe a vision for their potential roles in the future. With the Dearing Inquiry underway, there is much to debate about the future shape of higher education, and the potential role of learning technology within it. The pre-conference session will focus on this discussion explicitly, but many of the issues we discuss during the week will also be highly relevant to this debate.

ALT is a participative society and our annual conference provides an opportunity to contribute. A consequence of this is that the programme contains quite a large number of parallel sessions. These have been grouped under the conference themes, which we hope will enable you to find your way to the papers of most interest to you. The conference themes cover a very wide spectrum of topics, and in many ways this reflects a growing maturity of learning technologies as a discipline.

A wide range of social events has been arranged. This is also an important feature of the programme! In addition to furthering the aims of ALT, we hope that the conference will leave you with a taste of some distinctive features of Glasgow and of Scotland.

On behalf of all those involved in organising the conference, from the three host universities and from further afield, we hope that you enjoy ALT-C 96.

Shona Cameron	**Rick Trainor**	**Adrian Bowman**
Chair	Joint Chair	Joint Chair
Local Organising Committee	*Programme Committee*	*Programme Committee*

From left to right:
Adrian Bowman, Shona Cameron, Rick Trainor

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GLASGOW - THE CITY

City Chambers,
George Square, Glasgow

Located on the banks of the River Clyde, Glasgow is Scotland's largest city, with a population of around 740,000. The city had its beginnings in a monk's cell, when St Mungo founded a religious community in the sixth century. In the 13th century, the Cathedral of St Mungo was built on the same site.

At one time Glasgow was the Second City of the Empire, constructing locomotives, weaving carpets and building ships that brought back sugar, cotton and tobacco and made some of its citizens wealthy. Now the shipyards and heavy engineering industries are mostly gone, and the warehouses, once filled with the spoils of colonial trading, have become the desirable residences of the Merchant City.

Gone too is the dirt and grime, for Glasgow was quick to realise the importance of urban renewal. Over the past few years large areas of the city centre have undergone a transformation. Magnificent Victorian and Edwardian buildings have been sandblasted and restored to their true colours of pale gold or pink. Much new building has taken place, tastefully blending in with the old.

Culturally, too, the city is booming. The King's, the Tron, the Pavilion, the Citizens: Glasgow has a wide and varied theatre scene. Events such as Mayfest and the Jazz Festival have been established in the Glasgow calendar. Glasgow is home to more than 35 museums and galleries, which include the Burrell Collection, the Art Gallery and Museum at Kelvingrove, the Museum of Transport and the People's Palace.

Glasgow is also the headquarters of the top cultural triad: Scottish Ballet, Scottish Opera and the Royal Scottish National Orchestra. The RSNO is based in the splendid 2,500-seat Glasgow Royal Concert Hall.

Like many other major cities, Glasgow has seen a revolution in its shopping habits over the last few years, with shopping malls taking over from traditional department stores. The most spectacular of these is the St Enoch Centre in Argyle Street, a rainproof mega-shopping complex, complete with food court and ice rink. Off Buchanan Street is the more elegant Princes Square development, which has a continental atmosphere and a range of exclusive boutiques.

It comes as a surprise, however, to many first-time visitors to discover how easy it is to leave the city and explore the countryside. Some of the best hill-walking and climbing in Britain is within easy reach. The Firth of Clyde is ideal for sailing, as is Loch Lomond, whose "bonnie banks" are less than an hour away by train or by car.

Glasgow is an exciting, vibrant city and we hope that ALT-C participants will find time to savour as many as possible of the experiences on offer.

UNIVERSITY OF STRATHCLYDE

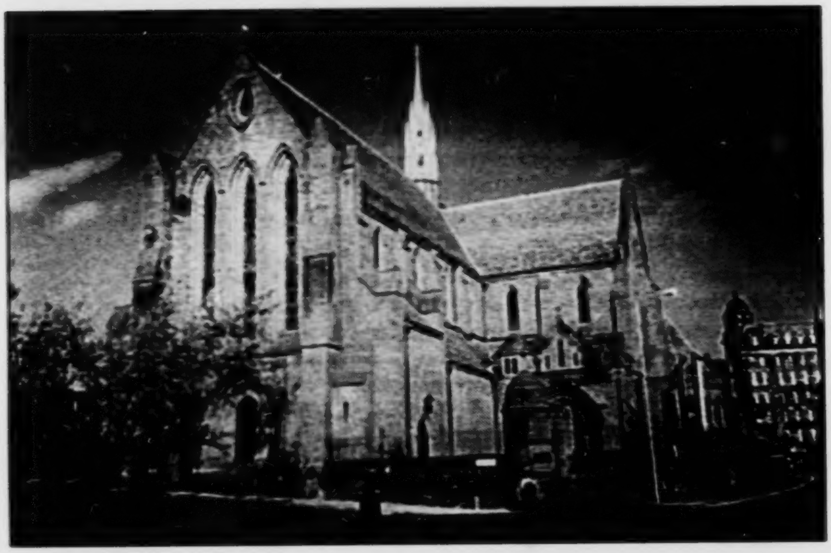
Strathclyde University was granted its Royal Charter in 1964. However, its history goes back to 1796 when John Anderson left instructions in his will that another education institution be founded in the City of Glasgow - Anderson's University. Today the name is different but the ethos is the same and reflects Anderson's wishes, that the work of universities should reflect the concerns and interests of society.

1996 is, therefore, Bicentenary Year with a busy and varied programme of academic conferences, social and ceremonial events. ALT-C 96 will bring around 400 people to the campus and we estimate that other national and international conferences will see a further 9,000 or so people visit Strathclyde and the City of Glasgow.

Since 1964 Strathclyde has grown to become Scotland's third largest university. The merger with Jordanhill College, which became the University's Faculty of Education, gives it a population of around 14,000 students, 4,000 of them postgraduates.

The University's newest Faculty has, in its former guise of Jordanhill College of Education, a long history of teacher training and is one of the largest and most highly respected institutions of its kind in the UK. It also offers courses in subjects such as sports, outdoor educaton, community arts, speech therapy, technology teaching, community education and social work. The Jordanhill Campus occupies an extensive parkland site in the West End of Glasgow.

The John Anderson Campus, which houses the Faculties of Arts & Social Sciences, Engineering, Science and the Strathclyde Business School, is located in Glasgow city centre, close to the City Chambers in George Square and to the Merchant City. This campus includes a Student Village where new buildings and creative landscaping have helped in the regeneration of the city centre. Two of Glasgow's churches - the Ramshorn and the Barony - have been restored with support from private donations and public agencies into innovative theatre space and a beautiful graduation hall and events venue. The University's estate was further enhanced several years ago by a new building for the Strathclyde Graduate Business School which won an award from the Royal Institute of British Architects (RIBA).



The Barony

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UNIVERSITY OF GLASGOW

University of Glasgow Media Services Photographic Unit

University of Glasgow in the summer

The University of Glasgow is the fourth oldest university in Britain. It was founded in 1451 by Papal Bull and originally classes were held in the Chapter House of Glasgow Cathedral. The University moved into its own buildings in the High Street in the 17th Century. Its scientists and economists played an active part in the steady industrialising of the city in the 19th Century, but as the University grew so did the industrial sprawl in the city centre and the University transferred to its current site on Gilmorehill in the West End of the city in 1871.

The magnificent main building designed in the Gothic style by Sir George Gilbert Scott is one of the city's best known landmarks. Some parts of the old University are incorporated in the present site including the Lion & Unicorn staircase and the Pearce Lodge - a 17th Century remnant, housing staff from the Computing Service.

Many famous scholars have been associated with the University including Adam Smith, the founder of modern economic science, James Watt, developer of the steam engine and William Thomson, later Lord Kelvin, after whom the Absolute scale of temperature, which he discovered, is named. Professor Macquorn Rankine wrote the first authoritative textbook on engineering and Joseph Lister pioneered antiseptic surgery. The existence of isotopes was first demonstrated in the University by Frederick Soddy.

Today research is pursued vigorously across eight faculties ranging from Divinity to Veterinary Medicine. The University has more than 16,000 students who enjoy a rich mix of traditional and innovative learning methods. Glasgow has been particularly active in technology assisted teaching programmes, such as CTI, ITTI and TLTP, during the past ten years.

The Reception on Tuesday will take place in the Hunterian Museum, Scotland's oldest public museum, which takes its name from Sir William Hunter, a student at Glasgow University in the 1730's, who later acquired fame and fortune as a physician and medical teacher in London. Hunter bequeathed his substantial collections, which include coins, paintings and prints, to the University. There have been many additions since Hunter's time, with an emphasis now on geology, archaeology, coins and art. Since 1980, the University's art collections have been housed in the Hunterian Art Gallery, and include an outstanding collection of European paintings, 18th Century British portraits, and a fine collection of 19th and 20th Century works by Scottish artists. Also housed in the Hunterian Art Gallery is the largest exhibition in the world of the works of the American artist, James MacNeill Whistler, including prints and drawings, as well as some of the artist's furniture.

GLASGOW CALEDONIAN UNIVERSITY

Formed in 1993, Glasgow Caledonian University is a major provider of professional and vocational higher education serving clients on a national and international basis.

More than 11,500 students attend the University and follow courses leading to a range of qualifications at undergraduate, professional and postgraduate levels. The University is also host to over 400 overseas students from about 80 different countries. Courses are vocationally orientated and the University maintains strong links with industry and the professions, enabling students to apply academic learning to real life situations.

The University is actively engaged in research across a wide range of disciplines. It has invested heavily in its research effort and this, together with the significant external research funding which the University attracts, results in a stimulating research environment within which to work.

Glasgow Caledonian University lies at the heart of Glasgow and has three campuses; City, the largest, is in the City Centre, and Park and Southbrae are in the fashionable West End. All three campuses are served by an excellent network of bus and rail links.

The University demonstrates its very positive commitment to adult students through the Centre for Continuing Education, which is charged with the task of improving and increasing access opportunities for adults and young people from all areas of the community.

The International Office promotes the increasing activities of the University in the international arena, and the University itself has direct links in the USA, Canada, East Africa, South Africa, Malaysia, China, Hong Kong, and Eastern and Western Europe.

AV Media Services, Strathclyde University

Scottish piper outside the City Chambers

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TRAVEL

By Air

Glasgow is served by Glasgow International Airport, eight miles west of the City and about 15 minutes drive via the City Centre motorway, into the heart of Glasgow. The airport is connected to the major London Airports at Heathrow and Gatwick by approximately 30 flights per day, with direct links to most UK regional airports. There are also regular connections to Dublin, Amsterdam, Brussels, Paris, and many other European destinations, via other airlines. Taxis are available at the terminal forecourt. The journey to the City Centre should cost approximately £12.50. Scottish Citylink Services (No 500) and Fairline Coaches operate from the terminal forecourt to Glasgow City Bus Station at Buchanan Street, and also stop close to Central and Queen Street main railway stations. This service is every 20 minutes and costs £2.00 single.

By Rail

There are two railway stations in Glasgow: Central Station, the main station for connections South of the border, and Queen Street Station, for connections via Edinburgh and the East Coast, and from the North. Glasgow has a high speed InterCity rail service to London (5 hours) with connections to most major UK cities (en route).

By Coach

Buchanan Street Bus Station is adjacent to Queen Street Railway Station and 10 minutes walk from the University of Strathclyde's John Anderson Campus (see map). Most major bus companies operate from here including National Express (who operate from most major cities). Silver Service and London Liner also have direct London-Glasgow connections.

By Road

(In view of parking limitations we do not wish to encourage travel by road, but if this is essential the following might be helpful.) From the South via the M74 and M8 motorways which lead directly into the centre of Glasgow. From the North via A82 and M8, and from the West or East via M8. Exit 15 for John Anderson Campus, University of Strathclyde.

Parking (or rather the lack of it)

Regrettably, there will be almost no parking available on the John Anderson Campus, so participants who drive to Glasgow must expect to park at one of the nearby (paying) public car parks. The NCP car park within the Campus boundary is recommended.

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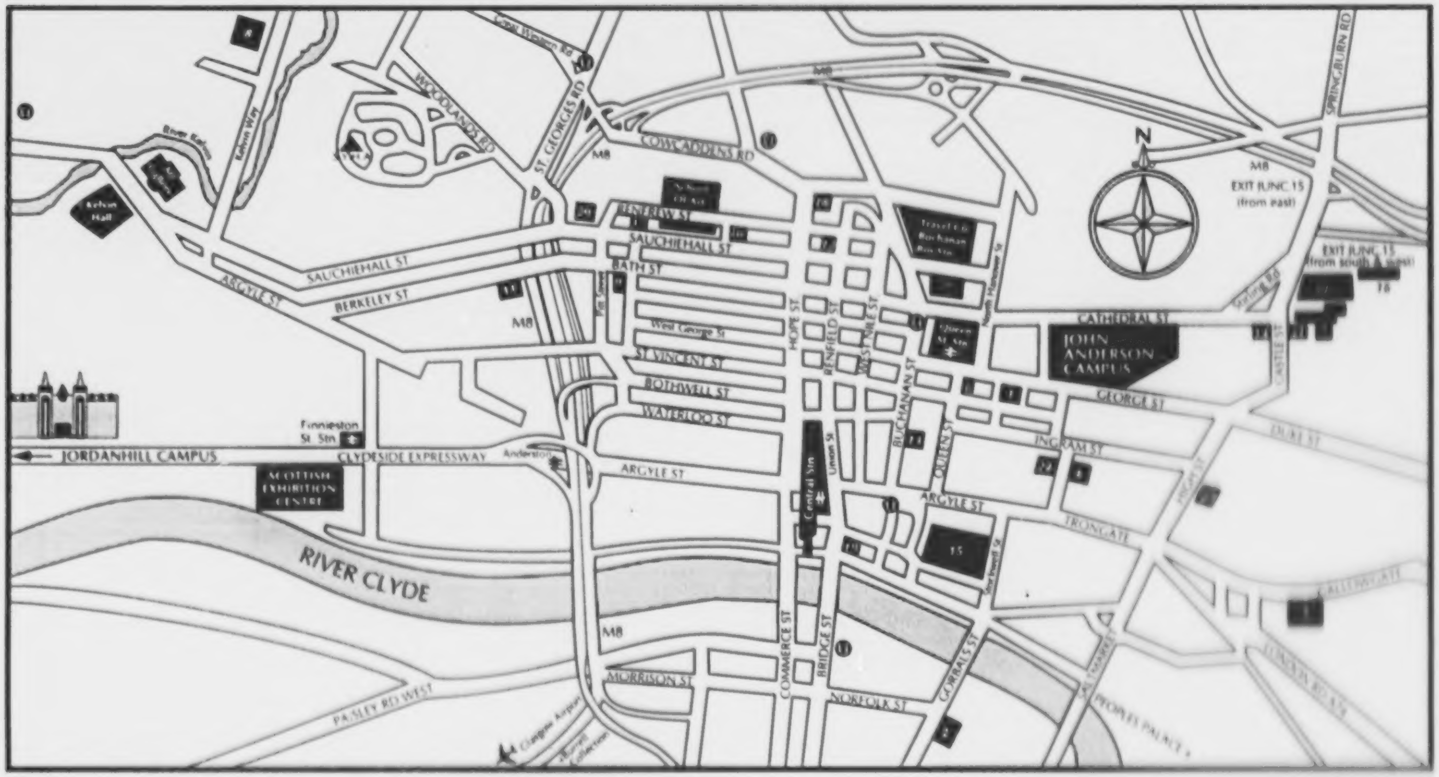
MAP OF CENTRAL GLASGOW



Andrew Ure Hall	23	Glasgow Royal Concert Hall	7	Royal Infirmary	22
Baird Hall	20	Hunterian Museum	8	St Enoch Centre	15
Barras Market	3	Kings Theatre	9	St Mungo's Museum	21
Centre for Contemporary Arts	17	McLellan Galleries	10	Townhead Health Centre	16
Citizen's Theatre	2	Mitchell Library/Theatre	11	Theatre Royal	18
City Chambers	1	Patrick Thomas Court	24	Tourist Information Centre	6
City Halls/Ticket Centre	4	Pavilion Theatre	12	Underground	U
Clyde Hall	19	Princes Square	13	Note: Queen Margaret Hall is off-map	
Glasgow Cathedral	5	Provand's Lordship	14	further west on Great Western Road	

SOCIAL PROGRAMME

Visitors to ALT-C 96 will find much to occupy and entertain them during their stay in the City of Glasgow. The rich cultural heritage, entertainment and shopping facilities in Europe's Cultural Capital of 1990 together with many other visitor attractions will add to your enjoyment of the Conference. Famous as the birthplace of Charles Rennie Mackintosh, Glasgow has been nominated as UK City of Architecture and Design 1999. The **City Chambers** and the **Kelvingrove Museum and Art Gallery** are two fine examples of the city's architectural heritage.

The conference is based at the John Anderson Campus of the University of Strathclyde and co-hosted by the University of Glasgow, where the Conference Dinner will be held, and Glasgow CaledonianUniversity.

Close to the University of Strathclyde is **Glasgow Cathedral**, which dates from the 12th Century and is one of Scotland's finest examples of Gothic architecture. The nearby **St Mungo Museum** of Religious Life and Art contains many religious paintings and artefacts. Salvador Dali's Christ of St John of the Cross is at the heart of the collection.

The Social Programme of the Conference starts on Monday evening with a Civic Reception hosted by the City of Glasgow in the impressive City Chambers in George Square. Following this, dinner will be served in the **Barony**, University of Strathclyde, with a Ceilidh afterwards.

On Tuesday afternoon there are optional excursions to the **Burrell Collection**, the **Museum of Transport** and the **Glengoyne Distillery**. If you wish to attend one of these excursions but did not register for them, please check at the Conference desk that there are still places available.

A reception prior to the Conference Dinner in **Hunter Halls**, University of Glasgow, will be held in the magnificent **Hunterian Museum**.

Further information on the Social Programme is available on the Conference Web pages at http://www.strath.ac.uk/alt-c/

and if you wish to take a virtual tour of the Hunterian Museum visit http://www.gla.ac.uk/Museum/

The Burrell Collection

Glengoyne is Scotland's unpeated malt whisky, made using traditional methods to allow a full appreciation of all the subtleties of this unique malt.

Glengoyne Distillery

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GUEST SPEAKERS

Professor John Spence
Vice-Principal Elect
University of Strathclyde

Professor John Philips
Vice-Principal
(with responsibility for IT)
Glasgow Caledonian University

Professor Sir Graeme Davies
Principal, University of Glasgow

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Photographic Unit, The Open University

Professor Diana Laurillard
Pro-Vice-Chancellor (Technology Development)
The Open University

CONFERENCE PROGRAMME

MONDAY 16 SEPTEMBER

0930-2000	**REGISTRATION at Conference Desk** (The Barony, University of Strathclyde)
1000-1300	**Set up time for commercial exhibitors, software demonstrations and posters** (Levels 4/5 Colville Building, University of Strathclyde)
1000-1230	**PRE CONFERENCE SYMPOSIUM: 'The status of learning technology - what the Dearing Commission of Inquiry should know'** (John Anderson K3.14, University of Strathclyde)
1200-1345	***Buffet lunch*** (The Barony, University of Strathclyde)
1215-1300	**Reception for New Members** (The Barony, University of Strathclyde)
1400-1410	**WELCOME and INTRODUCTION** ***Adrian Bowman, Shona Cameron and Rick Trainor*** (John Anderson K3.25, University of Strathclyde)
1410-1445	**OPENING ADDRESS: 'JANET and the MAN, an everyday story ... '** ***Professor John Spence, Vice-Principal Elect, University of Strathclyde*** Chair: *Professor Adrian Bowman, Department of Statistics, University of Glasgow* (John Anderson K3.25, University of Strathclyde)
1445-1515	***Refreshment break***
1515-1700	**Display of commercial EXHIBITIONS, SOFTWARE DEMONSTRATIONS and POSTERS** (Levels 4/5 Colville Building, University of Strathclyde)

POSTERS ***PAGE 25***

21 T-TIME (Technology for Teachers In Mathematical Education)
Harry Gretton, Neil Challis and John Callender (School of Science and Mathematics, Sheffield Hallam University)

37 Learning from the Teaching and Learning Technology Support Network
Robin Shaw (Robert Clark Centre for Technological Education, University of Glasgow)

56 The development of a computer based learning package to support the teaching of practical pharmacology
P C Freeman, N Naran and A Shum (Department of Life Sciences, University of East London)

57 Integrating IT into the first year curriculum for Life Sciences students
S Doonan, P C Freeman, D P Humber and V Siever (Department of Life Sciences, University of East London)

65 Is courseware affordable?
John Traxler (School of Computing and IT, University of Wolverhampton)

71 The development of a unified method for the creation of differentiated multimedia courseware
Samantha Bingham and Stephen Green (School of Computing and Mathematics, University of Teesside)

73 Development of a programme to deliver core IT skills within universities
Sally Barnes (School of Education, University of Bristol)

85 Information technology: a solution to work based learning
Janice McCall and Gerry Reid (Department of Nursing and Community Health, Glasgow Caledonian University)

91 Palm Top Computers: their contribution in integrating the technology
Stephen King (Guildford College, Guildford)

97 The Learning Technology Dissemination Initiative: implementations in practice
Jen Harvey and Nora Mogey (LTDI, ICBL, Heriot-Watt University)

109 New media, new methods: design considerations for formative computer based assessments
Paul Bocij (School of Maths and Computing, University of Derby) and Andrew Greasley (School of Business, University of Derby)

119 Lessons learned from the introduction of a computer based tutorial and assessment system
Jean Cook (Glasgow Caledonian University)

116 A programme for computer assisted learning in art and design
David Eaton (Central College, Glasgow)

136 Developments in course delivery at Hawthorn Institute of Education: past, present and future
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140 μ-SIC: a MUltimedia-based SIgnal processing Course
A J Anderson (Department of Electrical and Electronic Engineering, University of Paisley), W A Sandham, N Cameron, J Meldrum and R A Britten (Department of Electronic and Electrical Engineering, University of Strathclyde) and R F Daffurn (Faculty of Science and Technology, Glasgow Caledonian University)

141 DSP education and training within a multimedia framework
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171 Can computers make young engineers numerate?
M J Tierney, S Townley and N P Evans (Department of Mechanical Engineering, University of Bristol)

176 An outline for a fully integrated multimedia development package
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177 Virtually life on earth: using multimedia to complement teaching in biodiversity
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179 Using models for change
Su White (Interactive Learning Centre, University of Southampton)

186 Supporting the integration of IT into the curriculum
Barbara Watson and Janet Lewins (Information Technology Service, University of Durham)

190 Identifying and promoting the use of technology in teaching, learning and assessment at a university level
Paul Bailey (Technology Supported Learning, University of Plymouth) and Rhona Magee (Educational Development Services, University of Plymouth)

197 Desktop presentations in computer based learning: peaks and pitfalls
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211 Multimedia as a learning technology in engineering education
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213 CAL in numeracy for distance education students
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202 Supporting World Wide Web developments
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M J McAlister and M Grey (School of Computing and Information Systems, University of Sunderland)

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Jonathan Darby (University of Oxford)

HANDS ON WORKSHOPS *PAGE 50*

31 Computer visuals: vehicles for context and concepts in data analysis
James Currall (Computing Service, University of Glasgow) and John McColl (Department of Statistics, University of Glasgow) ***Colville 3.09B***

104 The educational use of mathematica notebooks
Allan Hayes (De Montfort University Leicester) and Wolfram Research Europe Ltd (makers of Mathematica) ***Curran 5.83***

239 ALT Homepage builder: an interactive web-based system for building and accessing homepages
Drew Tyrrell (Department of Library and Information Systems, University of Brighton) and Mike Harwood ***Colville 3.09A***

1700-1800 **Short presentations for SOFTWARE DEMONSTRATIONS** *PAGE 52*

GROUP 1 *Colville 4.20*

54 Examples of information technology in the teaching and learning of medicine at University College London
Roy Sargesson (Information Systems Division, University College London), Jane Young (Consultant Radiologist, UCL/NHS), Kim Issroff (Higher Education Research and Development Unit, University College London) and Tony Gardner-Medwin (Physiology Department, University College London)

58 CAL as a replacement for lectures in the veterinary curriculum
Vicki Dale and Martin Sullivan (Faculty of Veterinary Medicine, University of Glasgow)

106 Teaching dermatology to medical students by computer can increase their knowledge base
Gordon Skelly and Nick Simpson (Department of Dermatology, University of Newcastle)

215 CAL in a 3H biochemistry laboratory class
Brian Cook and Anne Kelly (Department of Pathological Biochemistry, Glasgow Royal Infirmary)

249 An interactive microscope for biology education: CD-ROM demonstration
Linda Baggott (School of Education, University of Exeter)

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GROUP 2 *Architecture G4*

34 Designing engineering design courseware
A Abbas, W McCracken and K J MacCallum (Department of Design Manufacture and Engineering Management, University of Strathclyde)

43 VISCP: a PC-based system for practical training of digital electronic circuits design and verification
Enrique Mandado, Dolores Valdés, Maria Moure and Loreto Rodríguez (Instituto de Electrónica Aplicada Pedro, Universidad de Vigo, Spain)

67 A recipe for the successful integration of computer technology into teaching and assessment (dait and chips)
Michael McCabe and Ian Troise (School of Mathematical Studies, University of Portsmouth)

131 Interactive flow cytometry multimedia
Sophie Hole (The Open University) and Nicholas Hole (ICAPB, University of Edinburgh)

221 CALF: computer aided learning in fluid dynamics
A H Littlejohn, K J Badcock and W S McMillan (Department of Aerospace Engineering, University of Glasgow), R M Watt and M Robb (Department of Mechanical and Manufacturing Engineering, University of Paisley)

GROUP 3 *Colville 4.16*

24 Computer based assessment at the University of Wolverhampton
Mike Thelwall (School of Computing, University of Wolverhampton)

61 Simulating chaos: experiences of an evaluation project
Eileen Scanlon, Shelagh Ross and Canan Tosunoglu (The Open University)

101 A collaborative system for computer assisted assessment based upon the World Wide Web
David Davies (Department of Physiology, The Medical School, University of Birmingham)

120 Tasmat: a computer based tutorial and assessment system
Michael Paterson and Jean Cook (Glasgow Caledonian University)

203 The al-Khwarizmi equation problem page
Chetna Patel (Robert Gordon University) and Philip Adams (The Library, De Montfort University)

259 Excel in assessment
Helen Watt and Barbara Cogdell (University of Glasgow)

GROUP 4 *John Anderson K3.17*

1 The French TLTP initiative at Queen's University Belfast
Peter Tame (Queen's University Belfast)

14 World Wide Web-based delivery for languages courseware
William Haworth (School of Modern Languages, Liverpool John Moores University)

35 Languages for all and software for all?
Christopher Jones (Department of Languages, Manchester Metropolitan University)

162 French grammar for experts: CALscribing the future
John Parkin (University of Bristol)

189 A case study of developing computer assessment of writing skills
Paul Bailey (Technology Supported Learning, University of Plymouth) and Brian Chalkley (Department of Geographical Sciences, University of Plymouth)

191 Increasing student motivation through the use of software packages
Paul Bailey, John Stainfield, Roger Catchpole, Jonathan Smart and Brian Chalkley (University of Plymouth)

GROUP 5 *John Anderson K3.14*

42 Developing interactive multimedia case studies at Aston
David Crowther and Matt Davies (Aston Business School, Aston University)

135 Commercialising TLTP courseware
Peter Davies and Timothy Brailsford (Department of Life Science, University of Nottingham)

151a Desktop multimedia communication
Jim Mullin and Anne-Marie Fleming (Department of Psychology, University of Glasgow)

151b Live demonstration: conference multicast
Jim Mullin and Anne-Marie Fleming (Department of Psychology, University of Glasgow)

161 The relevance of a user friendly interface in a multimedia language course
Ana Gimeno Sanz (Departamento de Idiomas, Universidad Politecnica de Valencia, Spain)

247 Interactive pronunciation
Don Friend (University of St Andrews)

GROUP 6 *Colville 4.10*

154a The STELLA Project teaching software demonstrations
Jean Anderson (STELLA, University of Glasgow)

199 Avoiding the gaps: the Open Learning Centre, providing a unified approach to supporting teaching and learning technology
Jane Williams and Cathy Hole (University of Bristol)

233 Question delivery over the World Wide Web
P Browning (Department of Geology, University of Bristol) J Crisp, J Williams and K Whittlestone (Educational Technology Service, University of Bristol)

240 The MARBLE project: online demonstration
Jeff Haywood, Hamish Macleod and Mary Cuttle (University of Edinburgh), Patrick McAndrew, Roger Rist and Sarah Price (Heriot-Watt University), Paul Dean, Ray Land and Eric Bonharme (Napier University)

257 The design of computer based learning programs: a solution to the problem of reproducing teaching-learning acts through the computer interface
Marsden Bradshaw (Staffordshire University)

GROUP 7 *Colville 4.11*

138 A generic multimedia toolbox for interface design
R A Britten and R F Daffurn (Faculty of Science and Technology, Glasgow Caledonian University), G Burns (Department of Engineering, Glasgow Caledonian University) and W Sandham (Department of Electrical and Electronic Engineering, University of Strathclyde)

139 Technology-based DSP education in Scotland
R F Daffurn, R A Britten and J Meldrum (Faculty of Science and Technology, Glasgow Caledonian University), N Cameron and W A Sandham (Department of Electronic and Electrical Engineering, University of Strathclyde) and A J Anderson (Department of Electrical and Electronic Engineering, University of Paisley)

175 A computer aided learning package for teaching structural design
C MacCallum and R Hanna (The Mackintosh School of Architecture, University of Glasgow)

195 A demonstration of several strategic institutional projects
Lawrence Hamburg (Learning and Teaching Institute, Sheffield Hallam University), Peter Hartley (School of Cultural Studies, Sheffield Hallam University) and Alison Hudson (Centre for Multimedia in Education, Sheffield Hallam University)

209 A CAL package for undergraduate quantity surveyors
Vian Ahmed (Department of Civil Engineering, Loughborough University)

253 Software course structure
Bill Tait (Department of Mathematical Sciences, University of East London)

1800-1830 ALT AGM (Colville 4.20, University of Strathclyde)

1845-1945 CIVIC RECEPTION (City Chambers, George Square, Glasgow)
Groups escorted by conference helpers will leave at 1830 from the Barony

2000-2400 ***Buffet Dinner followed by a ceilidh*** (The Barony, University of Strathclyde)

TUESDAY 17 SEPTEMBER

0800 ***Breakfast*** (Lord Todd, for Chancellor Hall Residents; Business School, for Business School and SGBS Residents)

0900-1045 **DISCUSSIONS and HANDS ON WORKSHOPS Session Two**

DISCUSSIONS ***PAGE 70***

GROUP 10 NEW DEVELOPMENTS ***John Anderson K3.25***

66 Factors affecting the quality of learning materials on the World Wide Web
Terry King (Department of Information Science, University of Portsmouth)

148 Clyde Virtual University
Linda Creanor (The Library, University of Glasgow), Niall Sclater (Computer Centre, University of Strathclyde) and Dave Whittington (Computer Science, University of Strathclyde)

240 Building, integrating and sharing WWW-based learning materials - the MARBLE project in Scotland
Jeff Haywood, Hamish Macleod and Mary Cuttle (University of Edinburgh), Patrick McAndrew, Roger Rist and Sarah Price (Heriot-Watt University), Paul Dean, Ray Land and Eric Bonharme (Napier University)

GROUP 11 EVALUATION ***Colville 4.10***

9 Fully integrated computer assisted language learning: mission accomplished
Brian McCarthy (Department of Modern Languages, University of Wollongong, Australia)

155 Computer assisted language learning applications: the case of the changing shell
Pepi Sarvary (STELLA, University of Glasgow), Erica McAteer (Teaching & Learning Service, University of Glasgow) and Mike Harland (Hispanic Studies, University of Glasgow)

156 From book to hyper-Toolbook: bridging the gap to teach language, history and society
Marina Orsini Jones (Centre for Information Technology in Language Learning, Coventry University)

GROUP 12 EVALUATION ***John Anderson K3.27***

28 Evaluating the delivery cost of technology-based and traditionally delivered modular courses
Ian Marshall and Alan Milne (School of Informatics, University of Abertay)

29 Investigating an integrated learning environment
Helyn Thornbury, Valerie Belton and Mark Elder (Department of Management Science, University of Strathclyde)

89 Integration from the students' perspective: factors that affect *fit*
Jennifer Hall (Department of Psychology, The Open University)

GROUP 13 EVALUATION ***Colville 4.16***

196 Evaluating the impact of WinEcon on teaching & learning of economics
Ziggy MacDonald (Department of Economics, University of Leicester)

198 Learning from self-evaluating courseware
Li Lin Cheah, Simon Price and Phil Hobbs (Centre for Computing in the Social Sciences, University of Bristol)

223 Course software with workbook: using WinEcon in economics courses
Jean Soper (Department of Economics, University of Leicester)

GROUP 14 NEW DEVELOPMENTS ***John Anderson K3.14***

32 An online electronic journal for teaching purposes
Jack Meadows and Fytton Rowland (Department of Information and Library Studies, Loughborough University) and Penny Yates-Mercer (Department of Information Science, City University)

86 Chadwyck-Healey's electronic home of the humanities
Julia Taylor (Commissioning Editor, Chadwyck-Healey Ltd)

113 New technology for interactive CAL: the Origami project
Robert Harding and Steve Lay (Department of Applied Mathematics and Theoretical Physics, University of Cambridge), Peter Robinson and Richard Watts (Computer Laboratory, University of Cambridge)

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GROUP 15 CASE STUDIES *Colville 4.20*

152 English (and Scottish) studies at STELLA
Christian Kay (STELLA Project, University of Glasgow)

153 The COMET project (Collection Of Modern English Texts)
Ann Gow (STELLA Project, University of Glasgow)

154b A guide to Scottish literature
Jean Anderson (STELLA Project, University of Glasgow)

GROUP 16 CASE STUDIES *Architecture G4*

170 Technology for teamworking in higher education: fixed time or flexible time?
Karen Valley, Christine Steeples and Patrick Hynes, (CSALT, Lancaster University)

166 Case studies in synchronous communications systems for teaching and learning
Charles Jennings (Southampton Institute of Higher Education)

167 The knowledge exchange: supporting it learning in art education through CMC
Chris Unsworth (University of Derby)

168 Tutorial support for remote learners using videoconferencing
Andrew Marriott (Learning Technologies Centre, University of Central Lancashire)

169 Flexible CMC for ALT professionals
Karen Valley, Christine Steeples and Patrick Hynes (CSALT, Lancaster University)

GROUP 17 CASE STUDIES *Colville 4.11*

90 Curriculum design and software integration: practice and theory
Patrick Allen (University of Stirling)

207 An evaluation of the use of new technology for purposes of language learning: the Internet for students of languages
Jean Conacher and Frédéric Royall (Department of Languages and Cultural Studies, University of Limerick, Ireland)

224 A case study - the Greenwich experience: coping with large numbers of students and multi-sites
Suzanne Healey (University of Greenwich)

GROUP 18 INSTITUTIONAL STRATEGIES *John Anderson K3.17*

44 The Academic Development Fund at the University of Derby: applying the experience and lessons of national competitive bidding
Chris O'Hagan and Jane Fry (University of Derby)

68 New directions in teaching and learning: Nottingham's teaching and learning strategy
Stephen Hibberd (Department of Theoretical Mechanics, University of Nottingham), Martin Binks (School of Management and Finance, University of Nottingham) and Joyce Graves (Cripps Computing Centre, University of Nottingham)

130 Achievements of a TLTP institutional project
Gordon Doughty and members of the TILT Project (Robert Clark Centre for Technological Education, University of Glasgow)

HANDS ON WORKSHOPS *PAGE 84*

20 Hand held technology tailored for mathematics: keeping up with the students
Harry Gretton and Neil Challis (School of Science and Mathematics, Sheffield Hallam University) *John Anderson K3.2*

50 Modelling global warming using MATLAB with SIMULINK *Curran 5.83*
C G Mingham and D M Causon (Department of Mathematics and Physics, Manchester Metropolitan University)

83 TREEFROG: towards intelligent examination stationery *Colville 3.09B*
Paul Strickland (Liverpool John Moores University)

246 Java - can control be returned to the teacher? *Colville 3.09A*
Ruth Thomas (ICBL, Heriot-Watt University), Douglas Robertson (Engineering Department, University of Cambridge) and Iain King (ICBL, Heriot-Watt University)

1045-1300 **Display of commercial EXHIBITIONS, SOFTWARE DEMONSTRATIONS and POSTERS** (Levels 4/5 Colville Building, University of Strathclyde)

Judging of posters by Dr Gabriel Jacobs, University of Wales

1045-1115 *Refreshment break*

1115-1200 **KEYNOTE ADDRESS: 'The role of the Teaching and Learning Technology Programme in enhancing the learning experience'**
Professor Sir Graeme Davies, Principal, University of Glasgow
Chair: *Professor Rick Trainor, Vice-Principal, University of Glasgow*
(John Anderson K3.25, University of Strathclyde)

1200-1300 **PAPERS Session One** ***PAGE 86***

GROUP 1 EVALUATION ***Architecture G4***

87 From cadaver to computer: incorporating computers into the anatomy topographical anatomy laboratory
Kim Issroff (Higher Education Research and Development Unit, University College London), Paul O'Higgins and Mark Osmond (Department of Anatomy and Developmental Biology, University College London)

254 Urology computer assisted learning programmes for medical students
Andrew Elves and Min Ahmed (Bristol Urological Institute)

GROUP 2 EVALUATION ***John Anderson K3.17***

15 The influence of learning strategy in a computer mediated learning environment
Pat Paterson (Department of Information Science, University of Portsmouth)

40 An assessment of the comparative effectiveness of three methods of multimedia learning
P Hogg (Department of Radiography, University of Salford), T Boyle (Manchester Metropolitan University) and R Lawson (Manchester Royal Infirmary)

GROUP 3 EVALUATION ***John Anderson K3.25***

103 Do students learn when they use simulations?
J D Milne (CLUES, University of Aberdeen)

144 Evaluating the impact of technology on education: a radical reappraisal of educational technology research
David Mitchell (Concordia University, Montreal, Canada)

GROUP 4 COURSE STRUCTURE ***Colville 4.20***

48 Plans for an international electronically-supported Master's degree
David Hawkridge (Institute of Educational Technology, The Open University)

70 MSc multimedia applications: a case study in developing a new Master's scheme at Teesside
Stephen Green and Elaine Pearson (Visualisation and Interactive Systems Research Centre, University of Teesside)

GROUP 5 COURSE STRUCTURE ***Colville 4.16***

67 A recipe for the successful integration of computer technology into teaching and assessment (dait and chips)
Michael McCabe and Ian Troise (School of Mathematical Studies, University of Portsmouth)

229 Computer therapy for algebra phobics
Karen Shipp, Tony Nixon, and Canan Tosunoglu (The Open University)

GROUP 6 CASE STUDIES ***John Anderson K3.26***

216 Facilitating a good learning experience: the acquisition of computing skills for students of business subjects
Anna Hobbs and Jim Snaith (University Business School, South Bank University)

255 Coping with diversity: the challenge of producing computer based tutorials for historians
Jan Broadway (TLTP History Courseware Consortium, University of Glasgow)

GROUP 7 INSTITUTIONAL STRATEGY ***John Anderson K3.14***

243 Cross-curricular IT tools for university students: developing an effective model of provision
Peter Kemp (Academic Services, University of Glasgow) and Allan Martin, (Office of Information Technology, University of Glasgow)

258 Working with the WWW in academia: a critique
John Scully (Liverpool John Moores University)

GROUP 8 STAFF DEVELOPMENT *John Anderson K3.27*

184 The impact of computer mediated communication on distance tutoring
Lynn Woodward (School of Health, University of Greenwich) and Malcolm Ryan (Academic Development Group, University of Greenwich)

244 The loneliness of the long distance learner: a participant's perspective
Fraser Lovie (Department of Politics and International Relations, University of Aberdeen)

GROUP 9 TEACHING AND LEARNING *Colville 4.10*

110 Development of a media selection support system
Carla Verwijs (Faculty of Educational Science and Technology, University of Twente, The Netherlands)

158 A systems-based framework for integrating technology in teaching and learning
Gordon Joughin and David Gardiner (Faculty of Law, Queensland University of Technology, Australia)

1300-1400 *Lunch* (Lord Todd, Campus Village, University of Strathclyde)

1400-1500 PAPERS Session Two *PAGE 96*

GROUP 10 EVALUATION *Colville 4.10*

17 An evaluation of learning diaries and technology as they impact on student learning
Harry Gretton and Neil Challis (School of Science and Mathematics, Sheffield Hallam University)

55 Multimedia motion: motivating learners
E Whitelegg (Centre for Science Education, The Open University), E Scanlon and S Hatzipanagos (Institute of Educational Technology, The Open University)

GROUP 11 EVALUATION *Architecture G4*

46 Supporting the learning of mathematics using computers
Hakim Moi (Praxis plc, Bath) and Ray McAleese (Department of Combined Studies, Heriot-Watt University)

114 Calculus Connections: the use of evaluator instructors
Robert Harding (Department of Applied Mathematics and Theoretical Physics, University of Cambridge) and D A Quinney (Department of Mathematics, Keele University)

GROUP 12 EVALUATION *John Anderson K3.25*

122 Integrative evaluation as an agent for change
Margaret Brown (TILT Evaluation Group, University of Glasgow)

178 Is interacting with computers interaction with knowledge?
Andrew Ravenscroft and Kenneth Tait (Computer Based Learning Unit, University of Leeds), Ian Hughes (Department of Pharmacology, University of Leeds)

GROUP 13 EVALUATION *John Anderson K3.26*

118 A systems analysis and design approach to the integration of learning technology into teaching
Greg Stoner (LTDI, Heriot-Watt University, Edinburgh: on secondment from Department of Accounting & Finance, University of Glasgow)

159 Integrating dimensions of learning, varieties of expertise, and organisational structure in technology-based teaching and learning
Gordon Joughin (Faculty of Law, Queensland University of Technology, Australia) and Jenny Winn (Computer Based Education, Queensland University of Technology, Australia)

GROUP 14 EVALUATION *John Anderson K3.17*

69 Integration of computer technology into a medical undergraduate curriculum: the King's experience
V Aitken and A Lewis (School of Dentistry and Medicine, Kings College, London)

93 Approaches to the implementation of learning technology in biology, business studies and humanities
Stan Zakrzewski and Joanna Bull (Unit for Learning Technology, Research and Assessment, University of Luton)

GROUP 15 CASE STUDIES *John Anderson K3.14*

23 Electronic questionnaires: using the Internet and World Wide Web to conduct CAL research
Philip Barker, Karim Manji and Check Meng Tan (School of Computing and Mathematics, University of Teesside)

206 Rich environments for active learning in the real world - a computer-based solution?
Stephen Bostock (Department of Computer Science, Keele University)

GROUP 16 CASE STUDIES *John Anderson K3.27*

117 Enriched distance learning and independent study: developing the means to support an innovative learning programme in higher education through video conferencing and the provision of online resources through the Internet
Elizabeth Foster and Sam Saunders (Work-based Learning Project, University of Leeds)

237 The re-skilling of a distance teacher: the staff developer's role and a practitioner's experience
Shirley Richardson and Jean Wood (Monash University, Australia)

GROUP 17 CASE STUDIES *Colville 4.20*

33 Introducing computer-mediated communication into a Women's Studies Course
Gill Kirkup (Institute of Educational Technology, The Open University)

60 Crossing the epistemological divide? How gender mediates the experiences of information technology use in a humanities course
Vanda Corrigan (School of Historical, Philosophical and Contemporary Studies, University of North London)

GROUP 18 TEACHING AND LEARNING *Colville 4.11*

76 The effectiveness and limitations of language learning advising in open and distance learning
Marina Mozzon-McPherson (University of Hull)

226 The integration of technology into the language curriculum: the staff development aspect
Brigitte Dold (Department of German, University of Greenwich)

GROUP 19 INSTITUTIONAL STRATEGIES *Colvile 4.16*

250 What use has Oxford for learning technology?
Jonathan Darby (University of Oxford)

256 Building an institutional information environment: the Glasgow case
Peter Kemp (Academic Services, University of Glasgow), Adrian Bowman (Department of Statistics, University of Glasgow) and Rick Trainor (Vice-Principal, University of Glasgow)

1500 **OPTIONAL SOCIAL EXCURSIONS**
Buses leave from Collins Street (near the Barony) for Glengoyne Distillery, Burrell Collection and Museum of Transport

1830-1930 *Coaches leave regularly from Collins Street, University of Strathclyde to University of Glasgow*

1900-2000 ***Reception*** (Hunterian Museum, University of Glasgow)

2000 ***Conference Dinner*** (Hunter Halls, University of Glasgow)
Guest Speaker: ***Professor John Philips, Vice-Principal with responsibility for IT, Glasgow Caledonian University***

2230-2330 *Coach shuttle service back to University of Strathclyde*

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WEDNESDAY 18 SEPTEMBER

0800 ***Breakfast*** (Lord Todd, for Chancellor Hall Residents; Business School, for Business School and SGBS Residents)

0900-1045 **DISCUSSIONS and HANDS ON WORKSHOPS Session Three**

DISCUSSIONS ***PAGE 106***

GROUP 19 DISSEMINATION ***Architecture G4***

10 Using the Internet as an enabling technology to promote learning
Brian Sloan (Department of Building and Surveying, Napier University)

13 Flexible access to electronic learning: potential applications of hand-held computers as CAL delivery platforms
Philip Barker (School of Computing and Mathematics, University of Teesside)

183 Providing virtual access to higher education: the University of Ulster ACTOR project
Gerry McAleavy, Gerard Parr and Stephen McAlister (ACTOR Project, University of Ulster)

GROUP 20 EVALUATION ***John Anderson K3.27***

74 The use and evaluation of CAL at home
Ann Jones, Canan Tosunoglu, Eileen Scanlon and Philip Butcher (Institute of Educational Technology, The Open University)

80 Future directions for CAL evaluation
Cathy Gunn (Centre for Professional Development, University of Auckland)

143 How good is our CAL?
Kirsty Davidson (Department of Mathematics, Napier University)

GROUP 21 EVALUATION ***Colville 4.16***

41 Two way interactive satellite tuition: lessons learned from recent Open University (UK) experiences
Anne Jelfs and Rosie Thomson (Institute of Educational Technology, The Open University)

185 The impact of computer mediated communication on adult, distance learners
Malcolm Ryan, Maude Gould and Tony Lewis (University of Greenwich)

245 The potential of interactive distance technologies in higher education
Fraser Lovie and Alasdair Mclean (Department of Politics and International Relations, University of Aberdeen) and David Newlands (Department of Economics, University of Aberdeen)

GROUP 22 EVALUATION ***John Anderson K3.26***

100 Evaluating multimedia teaching materials for an undergraduate distance learning science course: a three stage plan
Denise Whitelock (Institute of Education Technology, The Open University)

108 Managing multimedia: a model for the production of computer based assessments and multimedia courseware
Paul Bocij (School of Maths and Computing, University of Derby) and Andrew Greasley (School of Business, University of Derby)

212 The interaction of learning styles with varying levels of feedback in multimedia presentation
Myint swe Khine (University of Brunei, Darussalam)

GROUP 23 CASE STUDIES ***Colville 4.10***

3 CAL drug metabolism courseware in a pharmacology course - a case study
Paul Skett and Gavin McLellan (Institute of Biomedical and Life Sciences, University of Glasgow), Suzanne Cholerton (Department of Pharmacological Sciences, University of Newcastle) and Neil Kitteringham (Department of Pharmacology and Therapeutics, University of Liverpool)

133 Biodiversity in Nottingham: A case study of the design and delivery of a ten-credit multimedia module
P M C Davies, T J Brailsford, S C Scarborough and W J Trewhella (Department of Life Science, University of Nottingham)

235 The use of simulation software to improve the investigative skills of biology students
Paul Chin, Andrew Lawrence and Cris Woolston (Department of Applied Biology, University of Hull)

GROUP 24 CASE STUDIES *Colville 4.11*

62 Use of spectrum analyser software in education
Scott Larson and Robert Keddie (Department of Electrical and Electronic Engineering, Bell College of Technology)

107 Applying computer aided learning strategies in computer aided design: a case study of Architecture, Engineering and Construction teaching at the Mackintosh School of Architecture
Ra'Ed QaQish and Raid Hanna (The Mackintosh School of Architecture, University of Glasgow)

231 An evolutionary approach to computer aided learning
Patrick Lysaght and David Robinson (Department of Electrical and Electronic Engineering University of Strathclyde)

GROUP 25 ASSESSMENT *John Anderson K3.17*

49 The management of continuous computer aided assessment
Terry King (Department of Information Science, University of Portsmouth)

150 The Clyde Virtual University assessment engine
Linda Creanor (The Library, University of Glasgow), Niall Sclater (Computer Centre, University of Strathclyde) and Dave Whittington (Computer Science, University of Strathclyde)

210 Student assessment across a university campus network
Ian Upton (Information Services, University of Birmingham)

GROUP 26 TEACHING AND LEARNING *John Anderson K3.25*

164 NetMuse: a collaborative, subject-based approach to staff training
Celia Duffy and Stephen Arnold (Department of Music, University of Glasgow)

188 Training academics to use networked information: librarians as catalysts of cultural change
Jill Foster (Netskills, University of Newcastle), Jane Core (Edulib, University of Abertay) and Kay Flatten (TAPin, University of Central England)

234 Staff development for integrating technology into teaching and learning: lessons learnt at Oxford Brookes University
Carole Baume, David Baume and Alan Jenkins (Oxford Centre for Staff and Learning Development, Oxford Brookes University)

HANDS ON WORKSHOPS *PAGE 119*

112 Writer's Toolkit: software solution for writing *Curran 5.83*
Carole Gillespie (Development Manager, Scottish Council for Educational Technology)

126 Integrative evaluation *John Anderson K3.20*
S W Draper and TILT Group E (Department of Psychology, University of Glasgow)

172 Supporting flexible learning patterns through the use of computer mediated communications *Colville 3.09B*
Christine Steeples and Mark Bryson (Department of Educational Research, Lancaster University)

1045-1115 *Refreshment break*

1115-1215 **CLOSING KEYNOTE ADDRESS: 'How should UK Higher Education make best use of new technology?'**
Professor Diana Laurillard, Pro-Vice-Chancellor (Technology Development), The Open University
Chair: *Professor Rick Trainor, Vice-Principal, University of Glasgow*
(John Anderson K3.25, University of Strathclyde)

1215-1230 **Vote of thanks and final remarks**
Jonathan Darby, President of ALT

1230-1330 *Lunch* (Lord Todd, Campus Village, University of Strathclyde)

POSTER SESSIONS

MONDAY 16 SEPTEMBER 1515-1700

21

T-TIME (Technology for Teachers In Mathematical Education)

Harry Gretton, Neil Challis and John Callender (School of Science and Mathematics, Sheffield Hallam University)

The poster will consist of a collection of teaching and learning materials, assessment materials, and samples of student work, presented by a group of academics who teach mathematics to students from a wide range of courses. The change to a more technological approach is being carried out through various projects, one of which is the T-TIME (Technology for Teachers In Mathematical Education) project. The display will include among other things (on paper and on machine):

- motivational and context-related material and packages;
- diagnostic and self-assessment materials;
- materials relating to the TI-80, TI-82, TI-83, TI-85, TI-92, and the CBL;
- spreadsheet examples;
- samples of student learning diaries and case study reports.

37

Learning from the Teaching and Learning Technology Support Network

Robin Shaw (Robert Clark Centre for Technological Education, University of Glasgow)

The Teaching and Learning Technology Support Network (TLTSN) comprises eight support centres funded by the four UK higher education funding bodies.

These centres have arisen from eight of the institutional projects which were originally funded by the Teaching and Learning Technology Programme for a period of three years.

The TLTSN exists to disseminate the experiences of the institutional projects, in the area of learning technology, to the wider academic community.

The University of Glasgow TLTSN centre has specialist experience in evaluation, low cost CAL software and recycling existing learning packages, study skills packages, and the costs and benefits resulting from sets of alternative choices in investing in the application of IT to teaching and learning. The poster session will outline the work of the TLTSN and focus on the above experience.

56

The development of a computer-based learning package to support the teaching of practical pharmacology

P C Freeman, N Naran and A Shum (Department of Life Sciences, University of East London)

Employers of new graduates expect them to be technically competent, yet current trends in higher education make teaching practical skills problematical. Increasing class sizes and fewer timetabled laboratory sessions mean that there is less time for personal instruction and demonstration, highlighting the need for other information resources.

Staff in our department have wide practical experience. Faced with the problem of how best to pass these skills to the next generation, we are developing a CAL resource to support our practicals. This ideal medium can include reference data, instructional text, graphics, video clips and animations as well as self-assessment tests. The authoring platform is Authorware 3, the UeL standard, and the package is designed to run on the university PC network. The long-term aim is to produce a CAL package which can be built into and around traditional *hands-on* laboratory classes as an integral part of the learning process, without replacing the acquisition of practical skills. The advanced sections aim to help project students find out about unfamiliar techniques.

The following sections are under development:

General introduction: background information, experimental design, safety and good laboratory practice.

Isolated tissue preparations: details and hints for setting up commonly-used preparations.

Biochemical pharmacology: introduction to frequently used techniques, hints and methods (spectrophotometry, receptor binding, etc).

In vivo experiments: ethical and legal considerations, introduction to procedures.

Advanced techniques: introduction to electrophysiology, neurotransmitter measurements, signal transduction assays etc.

Authorware 3 provides the capability to analyse users' progress. This is an essential tool in evaluation of the package which, together with feedback questionnaires, provides guidance for further developments. In our experience, students welcome the opportunity to learn from CAL software, since they can control where and when they learn.

57 Integrating IT into the first year curriculum for Life Sciences students

S Doonan, P C Freeman, D P Humber and V Sieber (Department of Life Sciences, University of East London)

Our first year students have widely differing basal skills. Introduction of UeL's modular degree scheme provided the opportunity to develop a first year skills unit for all our students to provide study skills development, integration of IT into the common first semester curriculum and a top-up in core areas of biology, chemistry and maths and statistics .

Initially IT (wordprocessing, spreadsheets, email, Internet, library skills) was taught in lectures but we found that introducing hands-on sessions where students tackle short assignments for this part of the course has helped ensure they all acquire these transferable skills. Study skills development is monitored in personal tutor sessions. Each tutor group (8-10 students) forms a self-help group, meeting regularly to discuss items of common concern. Tutors receive minutes of these meetings. Core subjects are delivered lectures supported by a Workbook. Students are expected to use IT skills increasingly in all their units as the semester progresses, eg using email for communication and submitting assignments, as well as wordprocessing essays and practical reports.

Students provide evidence of their IT skills by submitting a Profile containing a curriculum vitae, their study skills audits, critical reviews, library and core skills assignments and minutes of tutor group and self-help group meetings. Core skills are assessed by a computer-marked MCQ test.

Computerised feedback questionnaires are used to gauge student reactions to the unit. In response to these we are providing more hands-on IT, MCQ test banks (with feedback) and CAL packages for chemistry and maths and statistics on the network. The Workbook will include chemistry next year and should also be available in a CAL format. Increased integration with first year units is sought, not just the first semester programme, so that students can develop and apply their skills throughout their studies.

65 Is courseware affordable?

John Traxler (School of Computing and IT, University of Wolverhampton)

At a conference last year in Dublin, Professor John Slater graphically identified some of the criteria that might be used to assess the cost-effectiveness of multimedia courseware. Elsewhere teams are working on various cost-estimation models and their cost drivers for multimedia courseware.

This poster looks at these and other sources to ask if they can be integrated within a rational and systematic framework that will define the most cost-effective ways to develop and deploy quality courseware and educational multimedia to teach computing in modern, modular high-volume institutions of higher education.

71 The development of a unified method for the creation of differentiated multimedia courseware

Samantha Bingham and Stephen Green (School of Computing and Mathematics, University of Teesside)

This body of work involves research and development of methods for multiplatform courseware design. There are discussions and various theories about how multimedia software applications for educational intent (courseware) should be put together in terms of organising their information content and presenting the information in a way that promotes learning for a particular group of users or an individual. Methods of structuring information for hypermedia applications have been suggested such as dividing content into single message elements and then linking these elements into a cohesive whole. Approaching the topic from a different subject area, constructivists believe the best method for creating educational software is for such an application to contain tasks where users actually apply the information learnt. The enjoyment factor of this approach leads to its success. Other articles address the issue that the assessment of users' understanding of educational content is of equal importance in the design of courseware. Also, effective access to information, ease of use and efficient management of content are considered relevant issues to address in courseware authoring development.

All the design issues mentioned above come under the general headings: navigation, learner modelling and graphic design. Navigation deals with the ease of use of the interface design and arrangement of content. Learner modelling describes the framework technique applied to educate the user. Graphic design is important in addressing the clear presentation and communication of information. To a certain extent these design areas overlap and complement each other in the process of courseware application development.

The initial aim of the proposed plan of research is to draw together all the design methods into a unified method. The methods highlighted will be applied to three case studies to explore the problems associated with multimedia application creation, learner modelling and the production of differentiated courseware. (Differentiated courseware refers to courseware presenting a topic in a number of different ways, each one relative to the user's level of understanding.) Each case study will provide evidence as to what extent the unified method is practical. Preliminary results will be discussed.

73 Development of a programme to deliver core IT skills within universities

Sally Barnes (School of Education, University of Bristol)

Historically, training in using information technology (IT) was provided only by those university departments which had degree requirements for specific IT skills. Today most, if not all, students make use of IT for the preparation of assignments, searching the literature, presentation of data in various ways, communicating via electronic mail, and discovering the uses of the Internet. The University's Teaching and Learning Group funded a one-year project to investigate how to develop a coordinated approach to provide good quality and equitable provision of training in IT skills to all students.

Most of us gain IT skills on a need to know basis. This approach may not help students gain the range and depth of skills they need to compete for jobs after graduation. Training in IT has usually focused on key presses. However, learning key presses alone does not provide an adequate base from which people develop their techniques or generalise their skills to different applications. Through this project we are looking at materials and methods of delivery which engender this type of concept learning as a way of providing a strong base from which individuals can continue to develop their skills.

A series of training needs analyses of academic departments, students, central services and key employers was carsied out. Not surprisingly, differences emerged between academic disciplines for IT skills. Students generally felt that they are not receiving adequate training across a broad range of skills. Employers tend to want recent graduates to have a flexible, confident approach to technology.

We are developing a flexible approach to materials and methods of delivery which will enable departments to mix and match materials and methods which best meet the needs of their students. A series of meetings, for people within academic departments who provide training in word processing, electronic mail, spreadsheet use, information services, and statistical packages, were held to discuss the range of materials and methods in use and develop a model for a good course. One area of work undertaken is the evaluation of teaching materials.

A pilot of some of these materials and methods with different student groups, involving as many departments as possible, was held in the Summer Term.

85 Information technology: a solution to work-based learning

Janice McCall and Gerry Reid (Department of Nursing & Community Health, Glasgow Caledonian University)

The Department of Nursing & Community Health at Glasgow Caledonian University has always been at the forefront of nurse education in Scotland.

In response to changes within the health care system in the UK which have resulted in increasing use of information technology for patient record keeping, decreasing availability of clinical practice placements for students and increasing demands from qualified nurses for clinically focused academic study, a series of curricular developments involving Information Technology are taking place within the programmes offered by the Department.

These developments focus on three distinct areas:

- a database of case studies which helps nursing students, and will eventually help multidisciplinary health care teams, to manage patient care in an efficient and cost effective way;
- multimedia packages which encourage the development of competence and confidence in nursing students in problem solving, prioritising care needs and crisis management;
- for experienced qualified nurses, the promotion of reflective practice by the creation and maintenance of comprehensive patient records.

Discussion is ongoing on the merits of self, peer and/or teacher evaluation of students' performance in each of these areas.

91 Palm top computers: their contribution in integrating the technology

Stephen King (Guildford College, Guildford)

The rapid evolution of hardware over the last few years has led to the technology becoming smaller, more powerful and cheaper. Those who have lived through the shift have encountered changing attitudes to the technology that have been equally dramatic. This started from the point where computers were for the technical expert with qualifications to match and now embrace almost every aspect of life.

Now palm tops offer computing power that previously would only have been available on a desktop PC. They are shaking off the lack of credibility caused by their association with cheap electronic diaries and are becoming an indispensable productivity tools for both staff and students. They promote a familiarity with the technology that benefits the user. I will look at their use by:

- students;
- academic staff working predominately on site;
- tele-working staff;
- management teams.

Is it cost effective to provide students with palm tops? Should it be a requirement of entry into certain courses that they have access to one?

Tele-working and *Hot Desking* are trends now being adopted by institutions; do palm tops provide the alternative to expensive lap tops, and if so, under what circumstances?

Management teams need to communicate in an efficient way and use Groupware. Do palm tops address this issue and can they be taken seriously as a productivity tool?

97 The Learning Technology Dissemination Initiative: implementations in practice

Jen Harvey and Nora Mogey (LTDI, ICBL, Heriot-Watt University)

The Learning Technology Dissemination Initiative was established in August 1994 to support academic staff in Scottish Higher Education Funding Council institutions who wish to use technology in their teaching. Over the past two years LTDI has been involved in offering detailed and practical support to new implementation projects, assisting in planning and promoting discussion of general educational and subject specific issues with departmental staff.

This poster will outline and describe some of the methodologies involved in carrying out such implementation projects. There will be an emphasis on the systems approach and the practicalities involved in introducing a new piece of software into an existing course. This will include the ongoing process which develops from an initial

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enquiry from an academic member of staff, through the planning stage involving discussion relating to instructional design and on to the process of evaluating the software with groups of students.

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New media, new methods: design considerations for formative computer-based assessments

Paul Bocij (School of Maths & Computing, University of Derby) and Andrew Greasley (School of Business, University of Derby)

New developments in multimedia authoring mean a wider and more sophisticated range of methods of assessment can be employed.

It is argued that a range of factors related to student learning and the characteristics of the target group must be considered throughout the development process. These include learning styles, age, ethnicity, gender and prior experience of information technology.

The poster will address the following important issues in relation to the realisation of learning outcomes:

- the type and amount of feedback provided for students;
- the amount of on-screen information needed during an assessment;
- question types and their use in assessing changes in learning;
- factors related to navigation and on-screen controls;
- screen design, transitions and methods of displaying information;
- the content and form of reports intended for use by lecturers;
- the development process and the time required to construct an assessment.

The conclusions offered were informed by a study involving more than 500 undergraduate students drawn from a number of courses. The study spanned a two year period and involved the development of a generic computer-based assessment package for use across a number of disciplines.

116

A programme for computer assisted learning in art and design

David Eaton (Central College, Glasgow)

The integration of art and design education with digital technology may take many forms of expression, from the use as *tools* at an immediate level to the creation of new media types. This poster will start to examine the potential of utilising multimedia as a source of reference for teaching contextual and research based work and thereby integrating visual resources within a digital form. It will work within the parameters of the white paper on the future of education in Scotland which will mean the instigation of a whole new educational structure at post sixteen, in the form of *Higher Stills*. The supporting poster will take as a model the Glasgow architect Greek Thomson and storyboard ideas and solutions based on support material for a student studying an Advanced Higher in Art and Design.

119

Lessons learned from the introduction of a computer based tutorial and assessment system

Jean Cook (Glasgow Caledonian University)

A computer based tutorial and assessment system has been introduced into several mathematics modules. It has been used to provide either part or all of both the tutorial element and pre-final assessment in these modules. In most cases lecture time was reduced, in one case to zero. The assessments were marked by the computer and immediate feedback supplied to the student.

In the tutorial mode hints or full solutions can be viewed by the student until the assessment is complete and the marks recorded. Student reaction and performance was monitored.

The software was developed in Authorware and consists of a discipline independent shell and a bank of questions with randomly generated parameters. It will be demonstrated in a related software demonstration.

136

Developments in course delivery at Hawthorn Institute of Education: past, present and future

Foster Adem (Hawthorn Institute of Education, University of Melbourne, Australia)

This presentation will trace the developments of selected course/subject delivery at the Hawthorn Institute of Education in the transition to various forms of information technology media. As a result of a period of development and implementation of networked software applications, a number of combinations have emerged as being valuable tools to aid in the delivery and fulfilment of course subject aims and content.

Meeting the course curriculum requirements as well as participant requirements required a realistic evaluation to arrive at optimum software applications, rather than the latest *razzamatazz* of upgrades and releases. Technological capabilities of people (entry level) and their access to software and hardware resources were major factors for consideration in course delivery both in and out of the classroom; on and off campus. The turnaround from learning, to producing outcomes using particular software applications, was of utmost importance. Preparation of learning packages, sequencing and communication of achievable yet challenging content and outcomes was an important determinant in the success of the course.

Student anxieties about new learning involving computer applications as well as new content, was both the high and low point for a range of different learners. Most made an admirable transition into the computer literate world and can never go back. Some did not get beyond the most basic level of outcomes, which were achievable with or without high order computer functioning (yet another consideration in course design). What lies ahead in course development is a rapidly changing context pressured by ever increasing institute policy demands for *"attention to technology-driven delivery, quality assessment tasks, lifelong learning considerations, and quality teaching matters in general"*.

These are some of the issues to be raised in this paper together with visual support, examples of programs and the means of computer mediated delivery, to be presented at the conference in keeping with the chosen theme.

140 µ-SIC: a MUltimedia-based SIgnal processing Course

A J Anderson (Department of Electrical and Electronic Engineering, University of Paisley), W A Sandham, N Cameron, J Meldrum and R A Britten (Department of Electronic and Electrical Engineering, University of Strathclyde) and R F Daffurn (Faculty of Science and Technology, Glasgow Caledonian University)

Traditionally, digital signal processing (DSP) has been taught using a combination of formal lectures combined with laboratories and tutorials. Now, with the increasing demand for quality graduates with a good background in DSP, and the present financial cutbacks apparent in most higher education institutions (HEIs), the requirement for efficient and effective student-centred learning in this discipline is assuming major importance. The advent of powerful though (relatively) inexpensive multimedia PCs, together with the global communication opportunities afforded by the Internet and the World Wide Web (WWW), offers new and exciting possibilities for DSP education using a more student-centred, interactive and integrated approach.

This poster reports on the development of a DSP CAL package called µ-SIC (MUltimedia-based SIgnal processing Course), which is based on the Matlab DSP package (with a number of toolboxes) integrated within Macromedia Director. Currently, the package has been developed for stand-alone multimedia PCs, using a CD-ROM format as the courseware medium. However, the eventual aim of the project is to integrate the package within the ClydeNET Metropolitan Area Network (MAN). Examples of effective DSP teaching using a multimedia environment include the following:

Data Acquisition and Conversion
The sampling theorem is one of the most fundamental of all theorems in DSP. Simulations are very useful here, showing simultaneous time/frequency domains for a bandlimited signal sampled using a variable sampling frequency.

Z-Transform
This topic lends itself very well to simulations, particularly pole-zero placements in the z-domain and their correspondence with the Fourier and Laplace domains.

Image Processing
Two-dimensional (2-D) sampling of an (analogue) scene eg photograph, to obtain a digital image, is an extension of 1-D sampling. Again, this can be illustrated effectively using simulations. A preset image processing sequence for segmenting an image (using the Matlab image Processing Toolbox) can be recorded and played back to a student as a video clip.

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Artificial Neural Networks (ANNs)

This topic represents one of the most exciting and important areas of DSP to emerge in recent years. However, although a number of commercial ANN packages and free software are available, together with many textbooks, no comprehensive education courseware is available using the powerful approach afforded by multimedia. Different ANN paradigms and training algorithms may be illustrated using simulations.

141 DSP education and training within a multimedia framework

W A Sandham and N Cameron (Department of Electronic and Electrical Engineering, University of Strathclyde), A J Anderson (Department of Electrical and Electronic Engineering, University of Paisley) R A Britten, R F Daffurn, and J Meldrum (Faculty of Science and Technology, Glasgow Caledonian University)

Digital signal processing (DSP) now constitutes one of the major modules in the curriculum of any undergraduate course covering electrical/electronic and/or information engineering. Advanced DSP theory and practice, also forms an important area of study for most one-year postgraduate courses dealing with communications, control, optoelectronics or information technology. This is a direct reflection of the many wide and diverse applications of DSP in the industrial, defence and commercial sectors.

Traditionally, DSP has been taught using a combination of formal lectures combined with laboratories and tutorials. A major problem with conventional lectures is their inability to simulate concepts and ideas. Also, although some excellent DSP laboratory sessions have been devised, based on a variety of commercial DSP and in-house packages, these can lack a sense of direction by the student. It can also be difficult to integrate the sessions with the lecture material.

This poster reports on the development of a number of computer-based, multimedia DSP course modules, which enable the student to:

- learn at his/her own pace using a fully integrated multimedia system incorporating hypertext, simulations and sound, image and video clips;
- passively observe Matlab simulations;
- actively engage in Matlab experiments;
- monitor their progress through problem solving and exercises using a (paper-based) workbook.

Specific examples of how multimedia can be effective in teaching these modules, will be illustrated.

171 Can computers make young engineers numerate?

M J Tierney, S Townley and N P Evans (Department of Mechanical Engineering, University of Bristol)

At Bristol, students take a four year Master of Engineering course, with the bulk of the basic analytical disciplines covered in Years 1 and 2. Traditionally, teaching is by means of lectures and example classes.

Much effort has been devoted to improving or replacing the lecture by Computer Aided Learning. Here we discuss two techniques that will improve a students' ability to understand and answer problems that require answers in either number or equation format. Both represent a substantial advance on current commercially available material.

The first approach provides *prompts* and *hints* advice to students solving problems in thermodynamics. The student must provide accurate numerical or multiple choice answers to each part of a question before moving onto the next. In the second approach the student has to answer questions on the fundamental equations of solid mechanics. He/she is given constructive feedback.

Both approaches have been tested on students in such a manner as to continually monitor and modify software design.

The paper discusses the philosophy of software design, a brief walk through an interactive tutorial, and the results of trials on students.

A single workmanlike interactive tutorial may be produced with 25 hours effort, of which five are required from lecturing staff. Given that 70 questions are set on our First Year Thermodynamics course, the resources needed to supply Interactive

Tutorials for a complete course are considerable but not insurmountable.

The contribution of our approach is in giving students encouragement and support in tackling substantial set problems in Engineering.

176 An outline for a fully integrated multimedia development package

P Cairney, A L Fidgett, D C Houston and D M Neil (Institute of Biomedical and Life Sciences, University of Glasgow)

The Division of Environmental and Evolutionary Biology at Glasgow University iscurrently designing and authoring a multimedia application for the purpose of teaching Animal Biodiversity to Honours Zoology students. (Refer to the accompanying poster by Fidgett et al for more information on the necessity for the development of such a learning tool.)

It is envisaged that the project will involve the following two modules:

1. A *shell*, in which the individual teaching units including any auxiliary material will be *authored*. This will allow the individual author to insert, delete and update text, video, sound and pictures; the text and media will be stored in a database. Text will be entered in an HTML-like markup language and it is hoped that the final version will include the following functionality:
   - a *lookup* and *retrieve* facility for all media to be inserted in the text;
   - full preview facility for all media;
   - the ability to insert text straight from an existing text file;
   - preview facility for resulting *Hypertext*.
2. The application proper, in which the authored material will be presented. In addition to the passive element of text, pictures, animation etc, it will also include question and answer sessions, interactive animation and a number of exercises, in the form of embedded applications.

Other general features will include source references, context sensitive help and a map feature indicating the position of the user within the application. The plan is also to control access and store relevant information in a multi-user database. It is important to note that the project is not intended to displace current teaching methods but instead complement them in a fashion ideally suited to computer-based multimedia. A substantial part of Module 2 has already been prototyped in Visual Basic 3.0 and the shell is being developed in Borland's Delphi object-oriented development environment at the present time.

177 Virtually life on earth: using multimedia to complement teaching in biodiversity

A L Fidgett, P Cairney, D C Houston and D M Neil (Institute of Biomedical and Life Sciences, University of Glasgow)

There is a widely acknowledged need for effective teaching in biodiversity, and the continued threat to species diversity is a major environmental issue. Over the last 15 years Glasgow University has developed a detailed set of self-teaching programmes on the animal kingdom, ranging from simple introductory classes lasting only one or two sessions, to a series of 40 one-hour sessions studying animal diversity in depth. Students work their way through structured teaching booklets linked to an extensive range of specimens from the Zoology Museum, including a wide range of material not normally on display, available for them to examine and handle. The Zoological Collections at Glasgow University contain over 1.25 million specimens, providing an extremely valuable teaching resource already extensively used in undergraduate courses at Glasgow University, but also to a lesser extent by Life Science students from both Paisley and Strathclyde Universities. These courses have been consistently rated highly by undergraduates and have proved a highly successful method of practical learning, running in parallel with lectures and laboratory sessions. However, major revisions to the existing undergraduate teaching timetable have led to a considerable reduction in the number of laboratory sessions which normally complemented the various self-teaching programmes, prompting a review of the programmes' content.

Rather than simply update the booklets to include extra material no longer covered in the practical laboratory sessions, a grant from the Scottish Higher Education Funding Council has allowed us to pursue the development of courses using modern computer technology. BioMedia (working title), aims to be a series of structured self-teaching CD-ROM packages. Incorporating sequences of live animals, diagrams of internal organisation and current explanations of evolutionary development, they will be used to interpret real museum specimens - a truly interactive learning experience!

Supplemented by a multimedia reference library of CD-ROMs drawn from the growing number commercially available on the animal kingdom, the packages will form a biodiversity database, accessible to students in each of the four participating universities; Glasgow, Glasgow Caledonian, Paisley and Strathclyde.

179 Using models for change

Su White (Interactive Learning Centre, University of Southampton)

There is a large amount of pre-existing research and literature which seeks to define models for implementing change. This presentation will begin to identify the ways in which university-based initiatives may be able to draw on the wider experience of managing change, and will look at the way in which the processes adopted by the Scholar Project at the University of Southampton can be mapped into such generalistic models.

The Scholar project based in the Interactive Learning Centre at the University of Southampton, was a phase 1 TLTP project with the remit to shift the culture of the University in such a way that hypermedia and multimedia became an integral part of the academic programme. At the end of TLTP funding the project has become a mainstream university activity within the Department of Teaching Support and Media Services. The Interactive Learning Centre is now one of the regional members of the Teaching and Learning Technology Support Network established by the joint funding councils.

186 Supporting the integration of IT into the curriculum

Barbara Watson and Janet Lewins (Information Technology Service, University of Durham)

The Teaching and Learning Technology (TLT) Section of the IT Service at University of Durham is a central service, which has been in existence since 1993, and currently consists of two Development Officers. Our aims are:

- to encourage, support and develop the use of IT in teaching and learning throughout the University;
- to provide advice, information and courseware development.

Support offered by the TLT Section includes:

- development and maintenance of CAL;
- training and support for other CAL developers;
- evaluation of CAL;
- adaptation of TLTP materials;
- use of computer based assessment;
- coordination and dissemination of information.

The initial use of CAL in the curriculum is often through the use of small CAL applications, developed either by the TLT Section or through funding by the University's Teaching and Learning Initiatives Fund. We collaborate with academics funded under this initiative and our central role enables us to offer experience and expertise on computing and pedagogical issues. The introduction of these small CAL initiatives, which supplement or replace lectures or tutorials, is often the first step towards the further integration of CAL into the curriculum. We have found that most of the academics who are currently using TLTP products have already used IT in teaching or are part of a TLTP consortium.

The TLT Section runs an awareness program that includes university-wide and departmental presentations, participation in the induction program for new staff, as well as pamphlets, Web pages, newsletters, and mailing lists. People involved in the field of educational technology may find it hard to believe, but there are still many academics who have had little experience of CAL and have not heard of CTI and TLTP. Consequently, we work in collaboration with CTI centres and TLTSN to obtain information and organise visits and Open Days. Our central role enables the coordination of activities across the University and provides us with an institutional viewpoint on the use of IT.

Institutional support of the use of IT in teaching and learning is provided through the existence of the TLT Section, which aims to provide appropriate levels of support to enable the effective integration of IT into the curriculum.

190 Identifying and promoting the use of technology in teaching, learning and assessment at a university level

Paul Bailey (Technology Supported Learning, University of Plymouth) and Rhona Magee (Educational Development Services, University of Plymouth)

The successful integration of technology into teaching, learning and assessment in an institution is subject to the successful development and implementation of a strategy which will encourage growth, break down barriers and provide support.

The Technology Supported Learning initiative has been set up to assist departments in developing and integrating technology into their teaching programmes. Our role is to enable technical and teaching staff to develop the skills and expertise necessary to exploit the new technologies.

To do this we need to be aware of current attitudes to the use of technology, the existing areas of expertise in the institution and what is already available or being developed at other institutions.

This poster will describe how we have:

- undertaken a survey of attitudes to technology in teaching, learning and assessment;
- carried out an audit of skills and expertise within the University of Plymouth;
- used this information to set up technology interest groups to assist in the sharing of ideas across the institution;
- used the experience of other institutions to develop a discussion programme;
- organised a Development Fund to support and assist projects within departments and to enable previous projects to share their successes with other departments/ faculties.

197 Desktop presentations in computer-based learning: peaks and pitfalls

Traci Davidson and Clive Wilson (Department of Pharmaceutical Sciences, University of Strathclyde)

Introduction of the new curriculum in the BSc Pharmacy course has provided the opportunity to exploit new teaching methods particularly with regard to computer-based skills. So far we have attempted to introduce students to the use of computers as information resource, as calculation engines and as a means of providing high quality output of essays and projects. We have sought to extend these primary skills utilising the computer to enable the student to design information packages. This activity, desk-top presentation, extends communications skills and provides the basis for an exercise in which the student can hunt for, sift, precis and present information. The exercise is demanding both in time and organisation but student reaction has generally been positive.

Now in its third year students work in teams of two or three. Data is gathered from original sources on a topic selected within the field of pharmaceutical sciences. This year the seed was an abstract from conference proceedings dating back five years ago. The task is to describe the concepts and the technology and to develop a visually appealing and informative computer presentation on the chosen subject. The teams are advised to make use of diverse information sources including reviews and journals wherever possible and thus use data search services such as BIDS EMBASE/ ISI and other online resources. This helps establish how the topic has grown in five years of developments.

Once all the information had been gathered the students were shown how to use the software package ClarisWorks to produce a slide-show mix of text and images. The use of diverse source material made for interesting and generally very high quality presentations; in addition to referring to recommended textbooks, library periodicals and graphics libraries on disk, students had written to companies for specific information on drugs/factors relating to their topic. Where appropriate they had contacted local pharmacists for relevant information and opinions. This was highly satisfactory since it provided us with direct evidence of students extending communication skills.

This project was generally embraced with enthusiasm by the students and the quality of presentations reflected the intellectual ability of individuals within the group. One major difficulty that students faced was the limited range and number of journals available within libraries. Perhaps this will be alleviated by future developments in online library services.

211 Multimedia as a learning technology in engineering education

M Macdonald, G T Taylor, T Britten and R Daffurn (Glasgow Caledonian University)

The poster outlines the development of a major initiative in engineering education directed at creating a learning rather than a teaching culture by way of the application of multimedia computer technology as a learning technology.

Engineering education is delivered through industrial artefact study, already well established at Glasgow Caledonian University, but this is combined with multimedia technology to provide a flexible, student-centred, learning framework for engineering students with the emphasis on the study of engineering products and systems drawn from industry.

The poster presents the rationale for the application of both artefact study and multimedia technology and depicts how they are brought together in a major project focusing on the study of a motorcycle. The poster relates the value of the educational approach and establishes the significance of multimedia as a learning technology in engineering education, its acceptability to students and staff and the economics of its development and implementation.

213 CAL in numeracy for distance education students

Canan Tosunoglu and Ann Jones (Institute of Educational Technology, The Open University), Karen Shipp and Philip Butcher (Centre for Educational Software, The Open University)

This poster will draw upon the methodologies and research activities to date centred on the evaluation of Numeracy CAL materials for an Open University (OU) foundation course *Living with Technology*.

The OU has been developing the use of computers in its teaching since 1974. Standard arguments for introducing CAL to traditional higher education institutions often centre around benefits of feedback and interaction. Such benefits may be of particular relevance to distance education students. In this context, investigating the nature of interaction between student and CAL material is essential. Evaluation of these materials can help to improve individual packages and provide guidelines for the design of future CAL materials.

The CAL Numeracy materials developed for Living with Technology are being evaluated in terms of their contribution to distance education students' learning and needs. These materials are provided in parallel with text-based materials covering similar topics and students can choose the medium they prefer.

For a number of years such materials have been provided to run under GEM. For the first time in 1996 the university's computing specification for students on this course allows the use of Windows. To make use of this opportunity, the Numeracy materials were extended and rewritten to run under Windows. To form a basis for the usage of Numeracy materials and compare usage in 1995 and 1996 a baseline data survey was carried out at the course's residential school in 1995. The same survey will be repeated in 1996 along with other activities designed to provide data about the effectiveness of the Numeracy CAL materials and the effect of interface change on the amount of use by students. At the residential school, we will collect data via questionnaires, intensive small-scale interviews and observation of students using the material to help us in the evaluation of the course software. In addition, students' use of the software and how the software relates to their performance in the course will be investigated.

227 Barriers to wider technology usage in higher education

Norma Pritchett and Bob Cozens (Department of Psychology, University of Luton)

The last two decades have been subject to a revolution in computer related technology; subsequently higher education has seen an increased level of assimilation of such technology into its teaching practices. In light of this an attitudinal survey of academic staff from a number of disciplines showed varying degrees of enthusiasm for using computational technology and varying perceptions of its possible uses in a teaching context. The survey examined the perceived barriers to the use of technology for teaching and assessment purposes. The results have implications for staff development and the provision of proactive support facilities.

232 Provision of targeted tutoring in mathematics for at-risk students

S Milne and J Cook (Glasgow Caledonian University)

Previous work enabled the development of a composite learner model containing individual characteristics of the learner together with records of activities while using a computer aided learning package.

It is anticipated that the application of this modelling technique will assist in the identification of a student's areas of strength and weakness. This knowledge may then be used to target provision of additional support to the student working in areas where he has weaknesses, and to select the form of the support provided to build on the identified strengths of the individual.

In applying the learner modelling techniques developed for the adaptive tutoring system ATULA, students are identified as belonging to one of a number of groups with different characteristics. The characteristics of the group are assumed to correspond with those of the individuals within the group. Areas for additional support are identified on the basis of group membership and the level of demand of the subject matter in the adaptation attributes.

It is possible that several modes of support provision could be made available, for example, entirely learner selected, entirely adapted to the learner by the system or adapted with optional extras. The mode of operation may eventually turn out to be a form of adaptation in itself, ie particular groups may be better served by using an alternative mode of support selection rather than being provided with support tailored specifically to their characteristics.

257 The design of computer based learning programs: a solution to the problem of reproducing teaching-learning acts through the computer interface

Marsden Bradshaw (Staffordshire University)

There are problems in the design of CBL programs which arise from the unsystematic, intuitive practices by which the tutor/author decides what learning activities students are to encounter. In short, the *hit-and-miss* approaches of traditional teaching, although perfectly adequate for the real classroom, are inadequate for CBL designs.

A solution lies in devising a curriculum design tool which the CBL designer can use to devise learning activities, with more system and certainty, which will engage the learner in those activities which will lead to understanding.

The design tool consists of the operation of two analytical components in systematic relationship to each other. The components are:

A classification of 15 Graphical User Interface activities (opening and closing *windows*, moving stuff about on screen etc) which mirror concrete operational thinking;

B a comprehensive array of cognitive tasks, one or more of which the learner must perform in problem solving.

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MONDAY 16 SEPTEMBER 1515-1700

Group 1 NEW DEVELOPMENTS

151 Desktop multimedia communication

Jim Mullin and Anne-Marie Fleming (Department of Psychology, University of Glasgow)

Recently much academic and commercial effort has been poured into the development of desktop multimedia communications facilities. Such facilities include not only traditional video conferencing (telepresence) but also the use of shared workspaces and environments (teledata). The Multimedia Communications Group (MCG) at the University of Glasgow has funding from various sources including BT, UKERNA, SHEFC, JISC, ESRC and the EC to research, develop, support and evaluate desktop multimedia communication and its application.

Real User Needs on ATM (RUNATM) is a project where the impact on users of high bandwidth multimedia services, such as remote travel and financial advice, is assessed. The Multimedia Integrated Conferencing for Europe National Support Centre for Scotland (MICE-NSC) has been set up to advise and support on academic use of desktop video conferencing. Training and Support for Communication using Multimedia Applications from the Desktop (TASCMAD) is an information, training and support service for the academic community on ClydeNET. Networked Expertise, Advice and Tuition (NEAT) has a mission to create, disseminate and evaluate an easy to use system for communication between advisees and their distant advisers.

202 Supporting World Wide Web developments

Mark Bryson and Susan Armitage (University of Lancaster)

The World Wide Web is one of the most pervasive innovations of recent years and it has a wide variety of uses. However, managing Web pages and their associated links can rapidly become an administrative nightmare. Not only do existing pages require maintenance, but new pages often need to be added and linked into the existing structure. Hand crafting applications for the Web can be a time consuming process, making rapid development of new ways of working on the Web problematic and costly.

At Lancaster University the Lotus Notes InterNotes Web Publisher (InterNotes) is the underlying mechanism used to support a number of activities on the Web. This paper describes these activities and discusses the usefulness of this innovation.

InterNotes manages the links between existing information. It incorporates new information in the appropriate place and adds links automatically. It also allows the same information to be viewed in different ways. For example, you could view a discussion chronologically or by author.

Guided tutorials to Web pages are made possible by the Web Navigator supplied with Notes. A tutor can produce a list of pages that they would like students to see and store them. A student then follows this tour of the Web. However, a major strength is that at any time a student can follow a link on a current page. This allows students the freedom to explore areas of interest outside those prescribed by the tutor. The student can return to the predefined tour at any time to resume the tutor's path through the information.

The advantage of using a mature platform like Lotus Notes for such development is that new models of activity can be rapidly prototyped for testing. Other advantages of using this integration are:

- students and staff are often already familiar with the Web interface, making the technology more transparent;
- Web pages can be *grabbed* by Notes - users can then work with the pages without losing the formatting as is often the case;
- Web pages can be searched using Notes' powerful full-text search facility.

218 Intelligent courseware for the World Wide Web

Moira J McAlister and M Grey (School of Computing and Information Systems, University of Sunderland)

This paper discusses the design and implementation of *intelligent* courseware on the World Wide Web (WWW) in the area of Operations Research.

Operations Research is taught within a final year undergraduate course as a module called Decision Systems. The module covers areas including inventory control, MRP, linear programming, simplex method, integer programming, PERT/CPM, forecasting, transportation/transhipment/assignment and Markov chains. At present the module is taught in a lecture/tutorial format. Extensive use is made of theorems, methods and schematic representation. Reduced teaching time on such modules means that courseware can be used to facilitate the students' understanding.

The authors have thus designed and implemented a system which uses the WWW as a platform to provide course material and satisfy the module syllabus. The system is required to meet a number of criteria including stimulus, tutorial interaction, processing of user input to provide a means of measuring performance and indicating weak understanding, self-pacing and providing links to relevant URLs for extended reading or as reference. The authors were also interested in providing a means of maintaining a user log to ensure that when they reused the system they were returned to their last point of study, and to recover from hangs on the WWW with reference to the links provided to relevant URLs.

The system was then tested and evaluated with recommendations being made for future work and conclusions drawn as to its success and worth.

Group 2 EVALUATION

96 CAL: a tool for learning. Fact or fiction?

Jayne Smith (Business School, Staffordshire University)

In March 1995, I completed a feasibility study commissioned by a private professional body which involved a critical evaluation of a large number of CAL evaluation studies. The original number of titles involved was over 800. Over 70 were deemed to fall within the scope of the commissioned study. The primary aim was to analyse experiments and research studies undertaken in the area of CAL Evaluation.

The study describes a general consensus of opinion that non-book metaphor interactive CD-ROM provides unrivalled learning opportunities for model creation and model investigation through developing progressive analytical and problem solving skills by simulation. The need for learners to develop these skills is critical in some fields where professionals are constantly faced with managing the effects of changes in critical, complex, unpredictable factors.

However, it is unlikely that this *expensive to build* learning resource is beneficial for all styles of learners and with all subject areas. Learning experiences which do not call for such in-depth interaction of complex knowledge domains might be handled by employing a CD-ROM design methodology which is referred to in the report as the computer based reference solution (Model 3). This learning solution is similar to that found in Encarta and other CD-ROM encyclopaedia. Keeping learners up-to-date with the latest scientific breakthroughs, research studies or changes in statutory regulations, if handled by periodic reissues of CD-ROM, can be very costly. A much cheaper alternative would be to use the Internet for this type of learning.

The mixed media solution of Model 2 is the report's recommended solution. Content which needs to be critically integrated within a large number of complex knowledge domains through the activities of simulation and model creation and investigation is handled by non book metaphor interactive CD-ROM employing a high level educational design methodology similar to that described in the BITE Project. Learning which needs to be regularly revised to keep abreast of ever changing technicalities is handled by an Internet component. All other learning is by educationally robust paper based open learning materials which incorporate cases studies and other problem solving activities.

123 The prospects for summative evaluation of CAL in HE

Steve Draper (Department of Psychology, University of Glasgow)

Many developers and evaluators feel an external demand on them for summative evaluation of courseware. They feel they are being asked to prove that the software *works*, to show that it is cost effective, that it is durable, that it is worth the price to the purchaser. However as soon as you start to attempt, or even seriously to plan, such studies the problems with this aim emerge. One is that the CAL may not be used at all by students if it is not made compulsory. This draws attention to the crucial role of motivation. If you measure learning gains, how do you know you are measuring the effect of the CAL or of the motivation in that situation?

Another issue is that of the actions of teachers, for instance engaging students in a Socratic dialogue based around the CAL. Obviously any gains would be affected, and probably dominated, by the teacher's skill. But to evaluate software in the absence of teachers is to measure a different situation than the most common one in HE, and furthermore would not get the most from the software.

These issues are the symptoms of the basic theoretical problem with summative evaluation, which is that CAL does not cause learning like turning on a tap, any more than a book does. Instead it is one rather small factor in a complex situation. It is of course possible to do highly controlled experiments: to motivate the subjects in a standardised way, to ban teachers from the computer lab (or train them to behave in a standard way), etc. This should lead to measurements of learning outcomes that are repeatable by other similar experiments. However they will be measurements that have little predictive value of the outcome when the CAL is used in real courses. Hence the normal view of summative evaluation must be abandoned. However it is possible to gather useful information by studying how a piece of CAL is used in a real course and what the outcomes were. Although this does not guarantee the same outcomes for other purchasers, it is obviously useful to them to know that the CAL has been used successfully one or more times, and how it was used on those occasions. Such studies can also, as we have demonstrated, point out failings of the CAL and suggest how to remedy them (eg by a handout or remedial tutorial activity).

132 The impact of CAL on teaching and learning in a third year immunology course

Sophie Hole (The Open University) and Nicholas Hole (ICAPB, University of Edinburgh)

With increasing student numbers in a third year immunology course, lecturers realised that staff time was not being used to its greatest effect. On the one hand, tutorial time with students was becoming extremely limited (15 minutes individual time), constraining the interaction of staff with students; on the other, restrictions in the availability of particular pieces of equipment (a flow cytometer) meant that for one practical unit, the hour session was repeated 16 times by the same lecturer.

In order to address this, two teaching strategies were adopted:

1 For one teaching unit, all the course content and revision questions were transferred to Web pages. Students were given instruction in accessing the information and allocated computer time for self-learning. The formal teaching sessions were then changed from lectures to discussion, with the lecturer asking, and being asked, questions on the unit topic by the whole class.

2 An interactive flow cytometry multimedia program was written to alleviate the pressure on flow cytometry equipment. The program covered the theoretical basis of flow cytometry, when it is used, the preparation of samples, the operation of the machines and the function of the components, the acquisition and analysis of data from virtual experiments, and a bank of test questions. Progress of the students was recorded anonymously by the computer.

The impact on learning was assessed by detailed student questionnaires before and after implementation, group interviews, interviews with students the previous year who were given the simulator to test, and interviews with staff.

Results from these analyses will be presented and the implications for introduction of such teaching strategies for other higher level university courses discussed.

Group 3 EVALUATION

81 A case for small scale description: ethnography and computer conferencing

Chris R Jones (Department of Sociology and Interdisciplinary Studies, Manchester Metropolitan University)

Computer conferencing is now used in a number of institutions for course provision. Many of the courses use computer conferencing to add flexibility and openness to courses taught on campus rather than through distance learning. This paper argues for the use of ethnographic techniques to evaluate this type of course provision, in particular for an adequate description of the accomplishment of teaching and learning online.

Ethnography as a research methodology is well represented in the emerging field of Computer Supported Co-operative Work (CSCW). Though there has been a parallel development in the educational field with the idea of Computer Supported Collaborative Learning (CSCL) there has been little or no development of ethnographic description. A persistent need identified in both areas of study has been an adequate understanding of group work as it occurs online. The research reported in this paper is a first attempt to fill that gap.

The computer conference produces transcripts detailing the system's use as a matter of course. Ethnographic techniques are used in this paper to inform the understanding of such transcripts. The use of ethnography in this way is a contrast to the use of content analysis as a research method applied to transcript analysis. In particular ethnography stresses context and refuses to use *a priori* categories or concentrate exclusively on the *learning process* . The use of computer conferencing is situated in an educational setting concerned as much with accreditation as with learning.

The paper is based on two years of research observing the teaching and learning undertaken online at Manchester Metropolitan University. The conferencing system used was FirstClass, and students were drawn from all years of the BAITS (BA in Information Technology and Society) degree. Elements of the experience are highlighted to illustrate the relevance of this type of research for course design and evaluation.

94 A distance learning computer science course

Tina Wilson (Academic Computing Services, The Open University) and Denise Whitelock (Institute of Educational Technology, The Open University)

Providers of distance learning courses world wide are beginning to realise the benefits of enabling their tutors and students to access online facilities. Learners are enabled to view and download supplementary course material in various electronic formats from plain text to full blown multimedia presentations. Projects investigating how both tutors and students interact in this electronically mediated learning process are becoming of increasing interest to both educationalists and designers of such systems. One such project is M205 - STILE (*Students' and Teachers' Integrated Learning Environment*). This second stage evaluation of the project compares student and tutor reactions to the World Wide Web (WWW) presentation of the course (using Netscape) as contrasted to their perceptions of the curriculum delivered via a conferencing medium (ie FirstClass). Different types of extra teaching material were made available online for the first five of the six blocks in the course. The conferencing material was in the form of exercises and the Web material in more of a tutorial style.

One of the main aims of this project was to improve the presentation of the course by enabling structured access to online facilities while providing a rich variety of communication not only between tutor and student, but among students themselves. The nine tutors and one hundred and ten computer science students situated nationwide and in Europe were online for the duration of their course in 1995 which lasted for ten months.

This paper assesses how distance learners made use of the online presentation of part of their computer science course. We will be reporting on their preferred presentation of course material, ie conferencing or WWW. The evaluation will also address the issues of how beneficial they found each type of presentation to their learning and which interface they found more appealing. We will present a range of empirical findings using a variety of evaluation techniques. These included monitoring:

- the frequency of student access to the online materials;
- the content of the email messages from the participants;
- online questionnaires completed after the students and tutors *online experiences;*
- a questionnaire which was designed to probe the tutors and student perceptions of the learning experience with respect to the WWW and conferencing presentations of the course material.

To conclude, our results cast light on student and tutor perceptions of these media and on how online material should be presented in future versions of this course.

99 Investigating the dialectic between teaching, learning and technology: CMC as a paradigm case

Erica McAteer (Teaching and Learning Service, University of Glasgow) and Andrew Tolmie (Centre for Research into Interactive Learning, University of Strathclyde)

The question, *"How do new technologies change people, groups and organisations?"* only deals with half of the problem. It should be completed with the second half, *"How do people, groups and organisations modify and adapt the new technologies to suit them?"*

Evaluative studies of Computer Mediated Communication (CMC) can produce misleading or even contradictory results due to an (understandable) focus on how the characteristics of the medium affect usage, ignoring the dialectic between technology and culture, of mutual adaptation over time. In Higher Education contexts CMC exchanges take place within a broader teaching and learning system, of which most participants already have extensive experience. Interpreting process and outcome events from such exchanges, therefore, has to involve:

- who participants see themselves as communicating with and why, how this serves longer-term learning goals, and what past experience of engaging with both task and audience they have had;
- what kinds of exchange the medium itself facilitates, and how such affects are honed over time;
- how these interactions impact on other aspects of teaching and on learning outcomes. As an illustration of what this approach would involve, the authors examine contrasting experiences of online seminars in two Humanities departments.

Group 4 COURSE STRUCTURE

134 Knowledge Tree: putting discourse into computer based learning

Timothy Brailsford and Peter Davies (Department of Life Science, University of Nottingham)

One of the major problems with the majority of Computer Based Learning materials that are currently in use is that they only model the declarative aspects of the learning process. If such courseware is used without careful planning this can be dangerous because one of the most fundamental aspects of education is the dialogue that occurs between teachers and students. Traditionally this has taken place in informal discussions, as well as in formal small group learning sessions such as the conventional tutorial. However as the staff-student ratio decreases so does the opportunity for this type of personal dialogue.

Modern networking technology offers a huge potential to add discourse to CBL. However there are many pedagogical problems involved with the intrinsically ephemeral and anarchic nature both of the Internet and of most conferencing or bulletin board systems. In this paper we describe a software system called Knowledge Tree (KT), which we have developed to address some of these issues.

KT combines a hierarchical concept-oriented database functionality with that of a USENET style bulletin board. Using this a knowledge garden may be developed for any subject area. These each contain a hypermedia database of frequently asked questions together with answers provided by subject experts. There is also a forum for live inter-student discussions of problems and issues. When students ask new questions these are automatically emailed to a relevant subject expert (determined by the position in the concept hierarchy). The answer is then placed in the database which eventually grows to become a valuable teaching resource.

KT is inherently discipline independent as the thesaurus can be changed to encapsulate any domain of knowledge. We have used it in support of conventional lecture courses (Biological Anthropology and Primatology), as an important component of a multimedia course (Biodiversity) and for general IT support. These examples illustrate the role that this system can play both in basic information provision, and in facilitating the discussion of deep issues.

160 Learning technologies: the *old* ones are still worth using

Arlene Gilpin, Ian Huntley, Elisabeth Lazarus (University of Bristol)

There is a temptation to believe that only *new* technologies are worthy of consideration - the Web, video-conferencing, digital video, or whatever - and to ignore *old* technologies such as floppy disks and email.

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In this paper we discuss some of the uses of these older technologies on teacher development courses, both pre- and in-service, for teachers of modern languages and English as a foreign language (TEFL), with illustrations of how a variety of materials are distributed via floppy disk, how rather crude search tools can be used in a very effective manner, and how email can be used for both communication and assessment.

We also explore some of the institutional issues surrounding such usage. The challenges of working in an environment where there are few PCs available to students, either at the university or at home, is a major issue. Equally important is inducting mature students, often with limited experience of using any technologies, even of the kind commonly used in libraries, into confident practice. Staff, too, may have only recently had access to a PC for regular use. For many, workplace applications are severely limited by such issues, and by the lack of time to develop skills and procedures for using technologies as learning tools. This paper describes a number of ways of dealing with these limitations, from the varied viewpoints of an expert, a proficient and a novice practitioner.

We conclude that there are real advantages of making materials available in simple electronic formats, even if these are not the most up-to-date, or even the most appropriate. Their user-friendly nature not only makes them effective, but also provides a confidence bridge into the use of more sophisticated technologies. Examples of well used procedures will be given, as well as some recent developments that are currently being piloted.

181 Using Lotus Notes to support the design, development and evolution of modular schemes

David Miller (Modular Degree Scheme, University of Central England) and Richard Riley (School of Computer Science, University of Central England)

In this paper we describe how we used Lotus Notes groupware (*Notes*) to support the design, development and evolution of a modular, multi-mode Computer Science and Information Management undergraduate scheme. We will argue that our use of Lotus Notes significantly improved the quality of the scheme design. We will then elaborate on the effectiveness of Notes in developing the final scheme documentation for validation and the efficiency it continues to provide in managing this evolving modular scheme.

A major problem in a teaching oriented University is that many academic staff need to contribute to new scheme designs but are effectively separated in space and time by the constraints of their varied timetables. We found that Notes effectively reduced that separation allowing staff to contribute as and when their schedules allowed. The main point being that Notes was able to model the scheme structure as it unfolded without the need to compromise any of the design decisions taken by the team.

A shared Notes database with a pre-defined structure that represented the scheme was used throughout. Staff were given a range of access rights in line with their scheme responsibilities. This shared database helped to propagate a sufficiently shared understanding of the meaning of the overall scheme structure and facilitated rapid sharing of information about aspects of the scheme. The judicious use of Notes allowed us to improve quality without extending the development time.

By its very nature a flexible modular IT-based scheme is going to evolve markedly in the time between validation events, typically five years. The evolving Notes databases have effectively managed this to the benefit of the staff and the students now on the scheme. The shared databases continue to represent the scheme documentation at any given point in time.

Group 5 CASE STUDIES

165 How to run a local WWW server: BOP, a local WWW server for the distribution of linguistic courseware and the communication between schools

Michiel Van Peteghem (Vlaamse Gemeenschapscommissie, Directie Onderwijs - BITS2, Belgium)

Since October 1995 the group BITS2 (Brussels Impulse for Technology and Software at School) has managed an information server - BOP (*Brussels OnderwijsPunt*) - for

140 Dutch speaking primary and secondary schools in Brussels. This information server is a central element in a wider CALL project.

Teachers and pupils connect with BOP by modem and the zonal telephone network (they don't need the Internet) and consult it through a WWW interface (Netscape). BOP offers texts, multimedia, target-vocabulary lists and ready made linguistic courseware which can be downloaded free of charge by any Dutch-speaking school in Brussels. Furthermore, the server provides means of communication for several projects that involve intensive contacts between pupils and/or teachers, such as the Pupils' Parliament. In this way BOP not only consists of a database on which teachers can find language-teaching materials, but also allows the communication between teachers and pupils from different schools.

During the presentation of BOP special attention will be paid to:

- the didactical context of BOP - presentation of the various services for teachers;
- the integration of CALL (and the information server) in the curriculum;
- the contents of the BOP database - texts, vocabulary lists and courseware;
- BOP as a means of communication between pupils and teachers.

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The Internet as a tool for collaborative learning: an international group working experiment

Christine Steeples (CSALT, University of Lancaster)

This paper reports on a project, which has established international student teams, that together have been investigating a common topic: finding resources and services available on the Internet. The teams have also used a computer-mediated communications (CMC) environment to appraise Web-based information and resources. The project presents a rich topic for students to explore, in a dynamic learning environment.

The teams are drawn from students in departments of geography at Lancaster, University College Galway, Ireland and Florida State University. The teams each consist of one student from each location, with four teams in total. The students from Lancaster and Galway are 2nd year undergraduate students, while the students from Tallahassee are doctoral students.

The broad topic chosen for the student teams was *Conflicting representations of the Third World found on the World Wide Web*, with an emphasis on identifying internal and external perceptions of Third World countries. Within this heading, the teams have designed their own investigation, for example focusing on a specific country or issues of population. The openness of the topic has ensured that students find a range of sources on the Web, representing different perspectives. The topic was also designed to encourage the students to confront criticality both in the topic and in the resources they find. We see this as essential to develop the students' understanding of the topic and to develop their skills in careful appraisal of Web-based resources.

To aid the students in their initial appraisal of resources, we created a set of guidelines on assessing Internet resources. These guidelines have grown and been refined during the life of the project. The students themselves are developing their own skills in identifying criteria for assessing online resources.

The structuring of international teams has been exciting to monitor. We have seen global groups in action, made possible though communications technology. The paper will report in particular on how each *virtual* group has developed: how roles within each group have evolved, how team members have approached resources with different cultural values, and how differences have been resolved.

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Integrating the World Wide Web as a learning resource

Patrick Hynes (CSALT, University of Lancaster)

The paper describes a study of the use of the World Wide Web (WWW) as a resource to support learning. Web resources are appealing since they are free, simple to obtain and up to date. The WWW has potential to provide a rich learning environment, but it is not without its problems. The principal focus of the paper addresses how we identified and resolved some of the problems of using the Web, for example:

- the variable quality of WWW resources;
- encouraging the sharing of found resources;
- providing annotations to resources;

- identifying the types of resources and styles of use which have greatest potential;
- slow access to some Web sites;
- maintaining a dynamic resource at minimum cost.

This case study is based on the Advanced Learning Technology (professional development) programme at Lancaster University. The aim of the study has been to investigate the integration of existing WWW-based learning materials into this programme. Prior to this study Web resources were used as supplementary materials. Subsequently, we will be in an informed position to make Web study materials essential to the programme.

The study, carried out over a period of ten months, used questionnaires and interviews to establish the views of course members and tutors. It began by providing a simple Web-database of *Useful Links*, to inform an investigation of:

- what use is made of the Web by learning technology professionals?
- does our *Useful Links* page meet the needs of the course members and tutors?
- how could we improve our integration of the WWW?

This enabled us to develop a wish-list of content and functionality for a shared database of WWW resources. These ideas are being evaluated using a ready-made solution (InterNotes Web Navigator) and a tailor-made prototype solution.

This paper will show how we tackled Web integration problems through developing our understanding of learner needs by using technology which can provide a solution with minimum development overheads. The results from this study have wide applicability across the HE curriculum and for campus and distance-based courses alike.

Group 6 CASE STUDIES

47 Encouraging students to reflect using asynchronous learning logs

Ray McAleese (Combined Studies, Heriot-Watt University)

Reflection ("*... the action of the mind upon itself...*", Samuel Johnson) is considered to be an important higher order learning skill. In an attempt to get students to develop the skill of reflecting *in* action, they are often required to keep a journal that allows them to reflect *on* action. This is common practice in engineering subjects. Although this can occur without the use of computer technology, there is an increasing use of email around universities and the advantages of asynchronous tutor-student contact using email is worthy of investigation. Apart from conventional campus operation, distance learning teaching is requiring more online tutorial support.

This discussion session will concentrate on data gathered from undergraduate students who are taking a credit bearing undergraduate study skill module (Problem Solving). As part of the module the students submit six weekly journals recording their study of problem solving. The tutor enters into a *discussion* with each student in order to enable reflection to take place, or to encourage different types of reflection. Data from two years have been collected. In all some eighty students have used electronic journalling. During this year the tutor has concentrated on using a style of questioning that is similar to *Socratic Irony*. The role of email is evaluated as it poses both benefits and problems. With asynchronous intervention by the tutor the students seem to be better able to provide plausible reasons for their actions and thinking. By contrast, the *cold* (as opposed to immediate and hot) nature of the tutor questions encourages the students to justify claims rather than developing deep level reflection on action. In this session I will:

- define and exemplify reflection as a higher order learning skill;
- describe the procedures for using email to record learning logs;
- report on the number and nature of interactions between tutor and students;
- discuss the importance of tutor questions - especially *Socratic Irony*.

51 Integrating module content and delivery through computer aided learning, computer based case studies and learner development

Mark Freeman (School of Computing and Mathematics, Huddersfield University)

The paper presents empirical research results, derived from student use of a Web based learning tool, into the implications of CAL in the design and delivery of theory intensive modules in Information Systems. The CAL material is in the form of an extensive series of interlinked, coarse grained case studies exemplifying the development of IT use by a range of nine organisations. Access to the learning aid is via the Web and the material is designed to integrate the standard module pattern of lead lecture and follow-up, as well as supporting the development of the tutor's role as a learning facilitator.

The design aims to support a cue, reinforcement and participation model of student learning. The cues identify what is to be learned and direct the process; reinforcement is related to the variety of the material and the frequency with which it is used; and participation relates to engagement with the learning process. In order to support this model the material is divided into different elements: storyboard material, examples, activities, definitions, interactive models, interactive formative questions and images.

Research methodology

The paper reports on the results of use of the tool to support 120 students on two Information Systems modules, one HND, one undergraduate. Each student was anonymously assessed prior to the module through completion of a prior approach to learning questionnaire. The results were then related to individual usage logs of the material . The usage log data is triangulated by: comparing the use of different elements to the design model, comparing the student results from meaning focused assignments and replicative terminal exams, and analysing student feedback from a bulletin board accessed from within the learning support tool.

Cues

These are represented by questions relating the factual, lecture material to storyboard elements in the case material. Responses to the questions are delivered by groups of learners at weekly sessions.

Reinforcement

The examples, definitional elements and models contained in the CAL material consolidate the learners' factual elements. However the material is designed to promote access to such reinforcement only through the storyboard context of the cases. This structure is explicitly designed to reward a deep approach to learning, through mixing iconic (images) and textual elements. Interactive, formative questions further reinforce the individual's learning to learn development.

Participation

The group work use of the case material for experiential learning and student led follow up sessions, consolidates a deep theoretical understanding of the subject area, by a focusing on learning issues rather than tutor delivery issues.

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Learning design by intention not accident

Michelle Montgomery (Department of Computing Science, University of Glasgow)

In the context of a book on Instructional Design, David R Krathwohl in 1983 said of teaching machines and programmed learning:

> "*Education was to be revolutionised. But that has not happened. Though the tantalising promise of these ideas remains, both teaching machines and programmed instruction have yet to achieve substantial educational roles*".

Thirteen years on and the current state of affairs is not much different. We must ask ourselves *why?* One possible reason could be Computer Aided Learning's (CAL) design methods or, more accurately, the lack of them.

> "*..compared to what it should and will be, today's interactive software is wooden, obtuse, clumsy and confused. The pervasive lack of imagination and good design is appalling*".
> (Nelson, 1990)

If any formal design methods are employed in CAL, it has been a top down decomposition approach, like early software engineering methods; overall educational aims are identified for the learning package and from these learning objectives are derived. These objectives are further subdivided until each objective can be directly implemented by a single teaching instruction. This paper suggests that the underlying model of the teaching and learning process in these design methods is not appropriate for higher education and proposes Laurillard's conversational framework as a more suitable model.

Diana Laurillard's *"conversational framework" (Laurillard,* 1993) takes a different approach to the teaching and learning process; the framework identifies twelve activities that should be performed by the teacher and student for each learning objective. This approach acknowledges that learning is not reliably caused by any single type of teaching event. As the name suggests the *"conversational framework"* promotes a conversation or dialogue between student and teacher, and a more interactive view of teaching and learning.

The conversational framework is used as the basis for a review of thirteen CAL packages, mainly from an institutional Teaching and Learning Technology Programme project. This paper details how the reviews were conducted, presents the results of the reviews indicating which activities in the framework are commonly supported in existing CAL packages and how they are implemented.

Group 7 ASSESSMENT

59 Using technology within the formal grading process

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Neville Neill (School of Computing and Mathematics, University of Ulster)

For the past four years final end-of-module Mathematics examinations have been taken in computer laboratories. The experiment began with the Numerical Methods modules in a Higher National Diploma course and have proved so successful that many BSc and MSc examinations are now organised in a similar manner.

This paper outlines the reasons which prompted this innovative approach to assessment and discusses such issues as:

- the logistics of organising laboratory based examinations;
- setting papers for which students will have access to a complete range of software tools;
- student reaction and performance;
- security implications;
- comments from other parties involved in the process, eg computer support staff, external examiners etc.

Examples of previous examination questions will be presented for discussion.

145 Using computer based tests for information science

Terry King and David Callear (School of Information Science, University of Portsmouth)

Computer based tests or CBTs, using the QuestionMark software, have been used extensively in the School of Information Science at Portsmouth, both for continuous assessment and for end-of-course exams.

When they have been used for end-of-course exams, problems have fallen into three categories: justification, practical problems, and staff misgivings and prejudice. CBEs have the overwhelming advantage that they make marking automatic and instantaneous, and some lecturers feel guilty about using them. It will be suggested here that they can be justified provided any aspects of student learning or objectives of the syllabus that the exam does not cover are covered by coursework assessment. Practical problems have been found to be less for end-of-semester exams than for continuous assessment, and can be almost eliminated by a cooperative network technician. Staff attitudes have sometimes been a major problem. Some worry about the *guessing factor* and insist on *negative marking* systems, some believe that only recall can be tested, some insist that questions must be clear cut with all answers but one clearly wrong, others label CBEs *experimental* although they have been used in public exams for thirty years or more.

225 The changing face of assessment in language learning: the portfolio as a pedagogical tool

Christine Taylor (Business School, University of Greenwich)

This paper gives a description of the integration of IT in the assessment of Language Learning at the University of Greenwich and deals with issues of assessing language activities carried out in the Language Centre.

I will explain the reasons for which we decided to balance the assessment between formative and summative and I will show the place IT has taken in the formative element of the assessment procedure.

I will explain what we mean by students' Portfolio and how the portfolio reflects the progress achieved by the student in the Language Centre using audio and video equipment as well as Computer Assisted Language Learning facilities (CALL).

I will show examples of Portfolios.

I will show how we supported the students in using these facilities by designing workshop activities which include activities in the four skills developed in Language Teaching: speaking, reading, writing and listening and I will explain how those activities using the Language Centre technology are part of the curriculum and linked to the programme covered in the teaching class.

I will underline the fact that we need to use IT in Language Teaching and in the assessment in a realistic way in terms of real life operations and performance conditions if we want our teaching to be valid.

I will explain how the activities carried out using the Language Centre technology on a regular basis of one hour per week develop the learners autonomy and help the student to play an active part in his/her learning process.

Assessing tasks carried out in the Language Centre using the facilities available represents a difficult exercise if we keep in mind that assessment should be valid, practical and reliable and I will explain how this could be achieved.

Group 8 INSTITUTIONAL STRATEGIES

36 Bottom-up meets top-down: an information strategy approach to technology in the curriculum

G C Campbell, Joan Day and Ian Winkworth (University of Northumbria at Newcastle)

The paper seeks to identify the key issues in making an institutional approach to technology in the curriculum effective. The authors argue that an institutional information strategy is required to underpin the application of technology to the curriculum in an economical way which achieves volume results.

The argument is based on a review of the published literature in the UK and elsewhere, together with the experience of UNN's *IMPEL* project which compares cultural change approaches to electronic working across UK higher education, and local experience in UNN, which has been developing an institutional approach to information since 1993, on the basis of a thorough-going convergence of library, academic computing, administrative computing, institutional planning, and institutional information management functions. The paper will cover inter alia:

- the key conditions for success;
- the role of academic and central departments;
- the role of committees versus executive officers;
- the handling of human resource needs;
- financial approaches;
- political issues.

88 Managing technological change in higher education

Rachael Scott (Department of Education, University of Cambridge)

Irrespective of the huge corpus of literature concerned with the management of change, little has been written regarding higher education and especially the implementation of technology within this realm. Rather, historically, there has been a far greater emphasis on the development of new technological applications. Comparatively, subsequent work then detailed the reasons for the failure of such innovations. Whilst more recently we are beginning to see a move towards work concerned with outlining criteria for success, still the process of managing technological implementation is being neglected.

In-depth case study research undertaken by this author within England is an attempt to move towards remedying this significant dearth. The methods of semi-structured interviews, documentary analysis and observation were employed at institutions of different ages, subject focus and IT development, in order to illuminate and understand circumstances and experiences across the tertiary sector.

The fundamental assumption underlying this research is that in order for practitioners to integrate technology into their institutions effectively they must understand the process of technological change.

Thus, this paper will outline ways in which change is presently occurring in higher education, along with advantages and disadvantages of such development; and individual and institutional issues for concern.

115 Central interference in local practice: a holistic and coordinated approach

Gabriel Jezierski (Learning and Teaching Support Division, University of Wales)

Attempts at understanding how new learning technology can be effectively introduced into the curricula have tended to focus on areas, such as the preconditions necessary for introducing it - institutional and strategic issues, the practicalities, such as IT skills training and staff development programmes, or policy issues such as teaching and learning strategies, in isolation.

Now that we are closer to having TLTP products and other learning technologies available, has sufficient account been taken of the interconnections, between institutional/strategic issues, academic staff at a local level, teaching and learning strategies and, teaching and learning services?

This paper will look at how taking a more holistic approach may help provide us with a more effective model for managing, introducing and embedding innovation and change into teaching and learning and the curricula in higher education.

It will briefly review our background understanding of the obstacles to the introduction of IT into the curricula, the concerted effort to introduce new learning technologies into higher education, vis a vis, the TLTP programme as well as reviewing some of the literature on resistance to changing practice at an operational level, eg diversionary activities to thwart it. It will then concentrate on strategy formulation, strategy dependencies and the practicalities of a teaching and learning unit implementing a teaching and learning strategy and the mechanisms for helping academic staff adopt new learning technologies at the local level.

Building on the work undertaken at the University of Durham (TLTP Project 45), it is based on the practical experiences, difficulties and successes of the author as Head of Learning and Teaching Support Division, in a new university, charged with the formulation of a Teaching and Learning strategy and the practicalities of implementing it at a local level within resource constraints.

Group 9 TEACHING AND LEARNING

26 Learning Technology Dissemination Initiative: supporting implementations

Nora Mogey and Jen Harvey (LTDI, Heriot-Watt University)

The Learning Technology Dissemination Initiative was established in August 1994 by the Scottish Higher Education Funding Council to support staff throughout Scotland in the integration of technology into teaching. Over the past two years LTDI have been involved in offering detailed and practical support to new implementation projects, assisting in planning and promoting discussion of general educational and subject specific issues with departmental staff. In addition to topics of generic interest such as assessment and study skills, subject areas that have been specifically targeted include mathematics, economics, modern languages, biological sciences, business & management and statistics. LTDI therefore has wide experience across academic subject areas and across different types of institution, and are uniquely placed to compare and contrast attitudes and experiences.

A number of different models for implementation support have been established, some involving a single lecturer, others requiring commitment from a large group of institutional staff, and demanding considerable supporting resources from the host institution.

This paper will discuss the importance of the provision of implementation support in order to encourage best educational practice, and will compare the effectiveness of different implementation strategies. Suggestions will be made for how institutions can best support and encourage their staff in the adoption of new technologies into teaching.

128 How can a teaching and learning service invest in the legacy from TLTP?

Gordon Doughty (Robert Clark Centre for Technological Education, University of Glasgow)

When the University of Glasgow's institutional TLTP project *Teaching with Independent Learning Technologies* (TILT) ended after three years, recommendations were made for the continued investment in staff skills, knowledge and organisation for developing and supporting IT for teaching & learning, so that TILT's legacy would not be wasted.

This paper describes how these recommendations have been implemented at the University of Glasgow.

Although many of the actions recommended would have been worth taking in isolation, the TILT Steering Group strongly urged a coordinated educational approach. A mixture of both bottom-up and top-down approaches was regarded as necessary to sustain success. The many teachers who have engaged in the use of IT for their students' learning should continue to be linked by informal networks. A need was identified for a service which responds to the demands of educational and IT issues and of users. To some this service would provide insurance against uninvited change, to others it would help to make teaching more productive, to others it would open up opportunities for radical reform of their teaching.

We recommended that a University service should provide a focus and support for Technology In Learning & Teaching and that the University should promote a stronger culture of giving and taking help in improving teaching. The support and coordination service for Technology In Learning & Teaching could have been a new unit, but would be better provided as part of an existing one - preferably the existing Teaching & Learning Service - so long as it provides a clearly identifiable focus. Education, rather than technology, should be the main thrust. Quality Assessment should play a considerable role. The IT part of the service should be staffed by an expert core, joined by departmental enablers and learning teachers on part-time secondment. Staff could be funded centrally or by subscription by Planning Units.

251 Eight years with the CTI: a personal reflection on learning technology in UK higher education

Jonathan Darby (University of Oxford)

The presenter has spent the last eight years coordinating the Computers in Teaching Initiative, the UK's oldest and best established learning technology programme. He will examine the changes that have taken place both in learning technology and its applications and in higher education as a whole and draw out the lessons learnt from the collective experience of the CTI.

Here are some issues that the presenter will address:

- why, when viewed dispassionately, has progress in the adoption of learning technology been at a snail's pace?
- why has there been a global loss of confidence in higher education?
- have we begun to properly understand new media yet?
- is the *Not Invented Here* syndrome all that it seems?
- what went wrong with TLTP?
- have the funding agencies acted responsibly?
- where does the real hope for the future lie?

Discussion will focus on participants' own experiences of learning technology and the successes and failures that they have enjoyed.

MONDAY 16 SEPTEMBER 1515-1700

31 **Computer visuals: vehicles for context and concepts in data analysis**

James Currall (Computing Service, University of Glasgow) and John McColl (Department of Statistics, University of Glasgow)

Statistical data analysis is an important element in many disciplines, a number of which traditionally attract students of modest mathematical aptitude. Two of the major obstacles to a good grasp of both the scientific method in general and data analysis in particular are a failure to:

- integrate analysis with context;
- grasp important underlying concepts.

This workshop will focus on the use of a variety of computer visuals as vehicles for tightly coupling context to data throughout the analysis and for developing an understanding of important underlying concepts.

To deliver such an approach requires changes to the way statistics is taught to both specialists and non-specialists alike. Delegates will work with materials from TLTP projects which link context to data analysis and tools which use visual techniques to explain concepts. They will then contribute to a wide ranging discussion of the problems of integrating such approaches into the way statistics is taught, with input from some courses where integration has been tried.

104 **The educational use of Mathematica notebooks**

Allan Hayes (De Monfort University, Leicester) and Wolfram Research Europe Ltd (makers of Mathematica)

The Mathematica system will be demonstrated and worksheets provided for hands-on work. A free disk of couseware samples will be available.

Mathematica can be thought of as a technical wordprocessor (allowing traditional mathematical text) that also performs algebra, calculus and statistics computations, generates graphics and has a mathematically oriented programming language. Hot text for referencing and jumping, and buttons and palettes for clickable control can be user defined. Extensive on-line help is provided. Dynamic links to other applications such as Microsoft Word, Excel and Matlab are available.

It is well-adapted to courseware for self-instruction and to use by students for reports and assignments; it is the same on all major platforms and is easily transmitted electronically, making it very suitable for distance learning and tutoring, student group work and collaborative teaching. It can also be used for letters and examination papers. Students can start with it in the first year with no need to know syntax, and progressively improve their skills over the years in several courses, until by graduation they have acquired a high degree of competence and familiarity with an industry-standard system.

Mathematica is used across a wide range of disciplines: mathematics, physics, chemistry, engineering, economics, accountancy, medicine, making it well suited to modular course structures. It is supported by a Web database, *MathSource*, well over one hundred books, a growing collection of application extensions and courseware. There is an active electronic user group.

239 **ALT Homepage builder: An interactive Web-based system for building and accessing homepages**

Drew Tyrrell (Department of Library and Information systems, University of Brighton) and Mike Harwood

The ALT Homepage builder is a forms based, interactive system allowing members to build their own ALT Homepage without any prior HTML or programming experience. Once built, pages can be accessed just like any other Web page, and can be edited or updated at any time. Members may use the system's search facilities to find information on other ALT Homepages and there is also an index of members.

The proposal for the workshop is to demonstrate the full functionality of the software as well as highlighting the potential for academia in creating systems to maintain their own internal WWW sites.

Whilst highly practical, the workshop will discuss and demonstrate how the system was designed, constructed and is now being maintained.

The Homepage builder system is one of the first interactive Web based developments to directly support the creation of a research community on the WWW. The first release of this system allows members to create and easily maintain a central collection of WWW Homepages.

The workshop hopes to inform potential and existing users of the capabilities of the system and to offer an insight into the wider vision of Internet and Intranet solutions for the creation of central knowledge bases for research organisations, academic institutions and the wider community across any platform.

The workshop will also hope to show the appeal of the system to users of different levels of expertise in the building of Web pages as it allows the inclusion of, and honours, HTML tags.

SOFTWARE DEMONSTRATIONS

MONDAY 16 SEPTEMBER 1700-1800

Group 1

54

Examples of information technology in the teaching and learning of medicine at University College London

Roy Sargesson (Information Systems Division, University College London), Jane Young (Consultant Radiologist, UCL/NHS), Kim Issroff (Higher Education Research and Development Unit, University College London) and Tony Gardner-Medwin (Physiology Department, University College London)

Networked resources and their delivery mechanisms are provided by traditional library and computing services. Together we form one side of a support triangle, academics are naturally at a second, and the third is formed by educational technologists. This paper outlines University College London's experience through two projects, LAPT and RASCAL. The challenge is to bring together experience from different fields in order to enrich the learning experience and to make more use of heavy investments in the underlying technology.

LAPT (London Agreed Protocol for Teaching) is a PC-based delivery system for self-directed learning that is being used in several fields of medical teaching. It incorporates Confidence Assessment - a novel feature that is intended to improve study skills, ensure better understanding of a topic, and discourage rote learning. This runs on the UCL local network, and provides extensive feedback to staff as well as allowing students to download most material for home study. The full system and further information are available at ftp://ftp.ucl.ac.uk/pub/users/cusplap.

RASCAL (Radiology and Surgical Computer Assisted Leaning) is a Web based tool which combines teaching and self testing materials delivered via a WWW interface. This is an evaluative project, the main aim is to assess the implications and impact of using networked teaching materials across a Medical School split over three major sites. Besides technical and resource issues the possible impact on the curriculum is being considered.

The problems of ensuring effective use of educational technology at UCL include: lack of financial resources for hardware, software and support; difficulties with ensuring that the software is available on a network; persuading academic staff of the merits; and a student culture which does not include learning with technology. Various initiatives, including the establishment of the Centre for Higher Education and Electronic Library Development, to overcome these difficulties will be described.

58

CAL as a replacement for lectures in the veterinary curriculum

Vicki Dale and Martin Sullivan (Faculty of Veterinary Medicine, University of Glasgow)

A number of packages have been developed within the CLIVE (Computer-aided Learning In Veterinary Education) consortium, to broadly cover the curriculum of higher education veterinary students. The *Physics of Diagnostic Imaging* package was developed at Glasgow in the 2nd year of the project, and is currently in use by students at Glasgow and at other veterinary schools in the UK.

This self-directed and self-paced approach to learning has been introduced to reduce the number of didactic lectures in a busy curriculum. The Physics of Diagnostic Imaging was designed to replace 5 hours of lectures. The cohort of 1995-1996 fourth year students have used the program, without attending lectures. The exam results have been compared statistically with previous years, providing some insight into student reaction to computer-aided learning resources and the relative success of the program as a teaching and learning tool. However, it will be some time before a true picture of the effect of replacing a fraction of the veterinary course with computer-aided learning resources emerges.

A summary of this is given in an illustrated poster accompanying the software demonstration.

The results of formative evaluation by students prior to examination will also be available for delegates to peruse. Previous student evaluation studies show that there

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is a demand for self-assessment material, and electronic resources eg digitised slides, which students can look at in their own time. The diagnostic imaging package is a structured learning tool which provides these facilities.

The hands-on demonstration will allow delegates to observe what information is included in the program and the different interactive styles incorporated to motivate the target users. Animations and problem-solving activities in particular help to illustrate or define difficult points in the physics part of the course. The modules were created using Authorware Professional for Windows.

106

Teaching dermatology to medical students by computer can increase their knowledge base

Gordon Skelly and Nick Simpson (Department of Dermatology, University of Newcastle)

We have developed a shell for the easy creation of computer assisted learning and self assessment material (CAL-CASA) on PC and Macintosh computers. The system is a truly generic tool that requires no knowledge of programming languages. Modules can be created simply by typing text and selecting picture, graph, video or animation resources from a library. Programs are based on the concept of core text supported by picture resources and expansion through keywords. The basic unit is a multi-branching screen, which can link with up to 4 other screens by hotlink.

The user interfaces for both authoring and learning were developed through extensive consultation with students and the final product is popular with both medical students and postgraduates.

Dermatology is a very suitable clinical discipline for computer assisted learning through a mixture of high resolution picture resources and text.

In order to test the ability of the system to teach medical students we have analysed the effect of a module concerning acne. This module consisted of 3 linear screens, 12 clinical pictures, 3 graphs and an animated video.

Thirty eight medical students were selected at random. All were in the first week of a 4 week dermatology attachment. Students were given 5 questions, drawn at random from a set of 10, before the module and afterwards answered the 5 remaining questions. Answers were accepted as true, false or don't know. The question set included one control, the answer for which was not available within the teaching module.

Results showed an improvement in the percentage of correct answers from 42% to 63% for 9 questions (Chi 2 = 28.2 $p>0.001$) and a decrease in correct answers to the control question (30% : 9%, before: after).

We intend to demonstrate the authoring and learning systems on a PC.

Our system is not a commercial product and was developed as part of the Teaching Initiative Project of the University of Newcastle upon Tyne and funded by the University's Postgraduate Institute for Medicine and Dentistry.

215

CAL in a 3H biochemistry laboratory class

Brian Cook and Anne Kelly (Department of Pathological Biochemistry, Glasgow Royal Infirmary)

There are 64 students in the 3H (Junior Honours) year of the BSc course in Biochemistry. These are divided into four groups of sixteen. Each group comes to the laboratory in the Biochemistry Department at Glasgow Royal Infirmary for five days (not consecutive) to determine concentrations of steroids in blood and in a sample of urine provided by each individual. During the course of the experiment, tutorials are given to explain the complexities of steroid biosynthesis and metabolism and the reliability of analytical measurement.

In the past, tutorials could be given only after ALL students had completed a particular task. Time was wasted while waiting for the slower ones. Also, the tutorials had to be repeated four times for the different groups. During the past few years, CAL programs have been developed to replace conventional tutorials. With these, students can access the learning materials in the computer cluster adjacent to the laboratory at anytime, for instance, while waiting for samples to evaporate or chemical reactions to complete. Gaps during experimental work can be used more efficiently. For revision, the programs are also available in an open access cluster and they can be borrowed on a disk for home use. Software has been written using the TenCORE authoring system and requires a PC operating under DOS or Windows with a VGA screen. Six units are available:

- Radioimmunoassay
- Steroid Biosynthesis
- Steroid Excretion
- Adrenals & Gonads
- Steroidogenic Enzymes
- Assay Validity and Quality Assurance

and others are planned. The last three were written by students: *Adrenals & Gonads* and *Steroidogenic Enzymes* as projects for an Honours Degree in Biochemistry and *Assay Validity and Quality Assurance* as a project for an MSc in Information Technology.

249 An interactive microscope for biology education: CD-ROM demonstration

Linda Baggott (School of Education, University of Exeter)

With increasing student numbers and budgetary cuts, the quest for educationally viable alternatives to bench-top practical work becomes more earnest. The microscope is a basic tool for the education of biologists and biomedical scientists, yet the student needs to observe and study high quality images, often not readily available, as well as acquiring skill in microscopy. These two processes do not easily complement one another.

A microscope simulation has been developed in this Department to allow students to practice the basic scientific skill of observation whilst freeing them from the time consuming preparation of fresh specimens, and inferior images seen with poorly set up or inferior microscopes. Supporting courseware has also been written to enable students to work independently in his or her own time and pace without the necessity for laboratory supervision. An evaluation study of the CD-ROM and its courseware is the focus of this paper. The functionality of the Interactive Microscope on CD-ROM and how it is used in students' learning of the scientific processes involved in microscopy is described. Student acceptance of the CD-ROM as an alternative learning route and mode of supported self study was also examined.

Two groups of students undertook specific microscopical tasks: one group did the practical work with fresh biological material and real microscopes, and the second group completed a similar task which was simulated on the CD-ROM. The practical work of the two groups was compared and the learning outcomes assessed. This procedure was then repeated with the first group using the CD-ROM, and the second group using microscopes. All students were interviewed about the quality of their scientific and learning experiences.

Group 2

34 Designing engineering design courseware

A Abbas, W McCracken and K J MacCallum (Department of Design Manufacture and Engineering Management, University of Strathclyde)

Engineering design is an essential activity of our modern technical world. Computer based teaching of such a rapidly changing discipline in which we are confronted with the open-ended nature of the design problem requires a new approach. The approach taken in this research is based on presenting students with an individualised, interactive and guided learning environment. The main elements of the approach are; a means of assimilating the student's learning knowledge and behaviour (the user model), and representing the instructor's guidance and assessment knowledge (the tutor model). Several principles are taken into consideration when designing such a learning environment. These include the structuring of the courseware material with respect to content, presentation and modularity, tailoring the presentation according to each student's level of competence, and identifying and utilising the teaching strategies involved in the learning process.

Several issues which have been identified with the Information Technology (IT) approach to teaching engineering design are addressed:

- The current and likely future difficulties in providing for individual tutoring in traditional teaching environments due to increasing student numbers and decreasing resources. Individualised courseware attempts to resolve this issue.
- The explicit presence of a user model adds valuable information to the instructor which is either non-existent or difficult to ascertain by traditional methods. Also

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the tutor model, within the learning environment, attempts to assess the student's knowledge based on information obtained from the user model and subsequently elects whether to provide guidance or not and how to provide it.

- The interactive and tailored characteristics of this approach enable the open-ended nature of design problems to be evaluated by considering the intermediate processes between the inputs and outputs.
- Although this approach is being applied to engineering design, it employs a generic architecture which is discipline independent and since the domain knowledge is separated from all other knowledge, the learning environment may be adapted to any other similar domain.
- The benefits of the IT approach associated with adaptable intelligent environments are addressed.

43 VISCP: a PC-based system for practical training of digital electronic circuits design and verification.

Enrique Mandado, Dolores Valdés, Maria Moure and Loreto Rodriguez (Instituto de Electrónica Aplicada Pedro, Universidad de Vigo, Spain)

Traditional digital electronic circuit design training was based on component assembly on prototype boards and the verification of these circuits was made using simple techniques due to the high cost of instrumentation. But when computers became popular, many CAD tools emerged to help the designer and virtual instrumentation techniques where possible.

Although some professional CAD tools have an important place in engineering training, it can turn aside the student from the fundamental concepts in the basic courses. This is due to the excessive time the student needs to manage these programs, which differ from one software or hardware manufacturer to another.

The proposed system (VISCP) is intended to provide the advantages of the above mentioned techniques (CAD and virtual instrumentation) inside a general, simple and friendly environment. Its main aim is to guide the student on the design, simulation and verification of digital electronic circuits. VISCP is a modular and open system that can be fitted for any area of electronic training. At this time, it is used for basic sequential circuits teaching and is being adapted to PLDs and FPGAs learning.

The VISCP consists of:

- A general purpose Schematic Capture program for circuit design including some features to prevent typical students design errors.
- A Netlist Generator linking the Schematic Capturer with traditional CAD tools. This program controls CAD tool running and makes the process transparent to the students. For example, VISCP constitutes a friendly interface to professional simulators where the student obtain the results without any interaction with the simulator.
- Virtual instruments for verification can be generated inside VISCP environment using a basic data acquisition PC-card. Virtual optimises the hardware resources and provides the possibility of adapting the front panel instrument to the educational application.
- VISCP has been oriented to the first courses of telecommunication engineering curriculum but can be easily adapted to other areas of electronic engineering.

67 A recipe for the successful integration of computer technology into teaching and assessment (DAIT and Chips)

Michael McCabe and Ian Troise (School of Mathematical Studies, University of Portsmouth)

Although Question Mark Designer claims to be the world's leading testing and assessment software, it has its limitations. It is not programmable and cannot call external DLLs.

Question Mark Designer tests are extremely useful in mathematics. Access to software tools is controlled, so that, eg one question is answered unaided, a second allows a calculator and a third allows computer algebra. Unfortunately, the adoption of this single CAA package is restrictive for mathematics, eg by not permitting random parameters and having limited graphical question types.

A mechanism has been developed for integrating the flexibility of external tests (developed using other software, eg Toolbook-CBT) within the framework of Designer. The benefits of more than one assessment package are thus exploited within a common *computer assessment management system*. An integrated test will be demonstrated.

131 Interactive flow cytometry multimedia

Sophie Hole (The Open University) and Nicholas Hole (ICAPB, University of Edinburgh)

Flow cytometry and sorting (also known as FACS) is an essential part of modern biomedical study, immunology in particular. However, these techniques use pieces of equipment that are very expensive, sensitive, and in great demand by researchers. Practical undergraduate use of flow cytometry and FACS is therefore extremely limited. We have designed and produced a multimedia-based interactive unit containing pictorial browse-through sections and tutorials that instruct the student in the different aspects of flow cytometry; the theoretical basis, when it is used, the preparation of samples, the operation of the machines and the function of the components, and the acquisition and analysis of data from virtual experiments. We have also included a data bank of visual and text-based questions to allow the students to test their knowledge of flow cytometry after progressing through the program. This application should allow university-level biomedical courses to offer practical sessions in FACS without the need for dedicated cytometers and technical support.

221 CALF: Computer Aided Learning in Fluid dynamics

A H Littlejohn, K J Badcock and W S McMillan (Department of Aerospace Engineering, University of Glasgow), R M Watt and M Robb (Department of Mechanical and Manufacturing Engineering, University of Paisley)

Fluid Dynamics is a key technology generic to many engineering disciplines. Recent advances in computer technology have led to the widespread use of Computational Fluid Dynamics (CFD) for the simulation of fluid flows. The adoption of CFD as a powerful tool in research and development makes it essential that engineers are proficiently educated in the underlying physics, maths and computing. Conventional courses present the student with difficulties in developing skills necessary to make reliable judgements in CFD calculations. Therefore, a course presenting theory in a practical context is desirable.

The CALF course, Computer Aided Learning in Fluid Dynamics, is a multimedia course currently being developed at the Universities of Glasgow and Paisley. Funded by SHEFC, this project aims to meet the challenge of enabling students to develop new skills by merging CFD theory with hands on experience in using software and interpretation of results. The visual aspect of the course, incorporating video and animation sequences, is designed to increase the student's motivation and to make the course more lucid. Beginning in January 96, this 7 month project has progressed very rapidly. A general pedagogy has been adopted enabling the student to learn by question/ feedback sessions with some scope for experimentation. The course is navigated by means of navigation icons and student progress is logged. Over 2 hours of material developed during March underwent an independent, formative evaluation by the TILT group at Glasgow University, the results of which have been extremely encouraging.

The decision to create a course which was truly cross-platform led to development in HTML (Hyper Text Markup Language). Many of the limitations of using this delivery mechanism have been skilfully cornered by use of CGI scripts linked to small programs written in C. CGI scripts are also used to dynamically change the route through the course based on student progress. Email and videoconferencing between the Universities of Glasgow and Paisley has been tested for use in the final course delivery.

This presentation will describe the technical and pedagogical aspects of the course development, the ways in which CAL can enhance the teaching of CFD and fluid dynamics and the use of the ClydeMAN network for the remote delivery of courses.

Group 3

24 Computer based assessment at the University of Wolverhampton

Mike Thelwall (School of Computing, University of Wolverhampton)

This project is procducing computer based tests for modules at the University of Wolverhampton. The tests are to replace, and be equivalent to, written tests and are designed to be used by staff and students with no knowledge of computers. The three tests that are in use at the moment are in statistics, information technology and maths. They will be used by about 1,000 students each year. They have run smoothly and been well received by staff and students. Staff members have been particularly pleased to avoid any marking. As a result of our experience we have become confident that computerised tests can successfully assess at least some of the material taught in many courses.

The project aim was to save lecturer time by producing practical, error-free products that both set exams and mark them. In response to this we have written programs that randomly generated a new test each time they are run, with a nominal 80,000 possible variations. Due to the random element involved, they will be used year after year without any changes. To design the tests we chose a windows based programming language as the environment best capable of producing the tests with the necessary quality and reliability. We deliberately avoided multimedia, big graphics and network interaction to make the tests run fast and reliably.

A big bonus from the project was that the students were keen to use the assessment programs as revision tools and spent many hours practising on them. In this respect the programs have been more successful at Computer Based Learning than the dedicated CBL software that we use. This ties in with our experience in maths with internally and externally produced CBL software that our students like it when it tests them and gives them feedback.

The future plans for the project are to expand into new subject areas outside science and to market the programs to other universities and schools.

Demo versions of software are available via ftp from the directory:
scitsc.wlv.ac.uk/pub/ComputerBasedAssessment/

An Internet site containing information and demo software is available for the project at http://www.scit.wlv.ac.uk/~cm1993/

61 Simulating chaos: experiences of an evaluation project

Eileen Scanlon, Shelagh Ross and Canan Tosunoglu (The Open University)

This paper reports on the use of the Driven Pendulum software as part of the teaching for the Open University course Discovering Physics. A driven damped pendulum is a suitable instrument for experimental studies of chaotic motion. A computer simulated experiment was programmed by the Centre for Educational Software, the underlying mathematical model being produced by the physics department at the Open University. The main aim of the simulation was to allow students both to observe some of the generic features of chaotic motion, and to explore ways in which these may be represented graphically. This simulation formed the basis of a three hour experiment for students which provided them with a number of learning opportunities, eg a means of tracing out state space trajectories for various types of pendulum motion, in order to appreciate the advantages of the state space representation for analysing complicated behaviour. More generally the experiment also aided the consolidation of ideas about oscillations, damping and resonance.

We conducted an evaluation of the Driven Pendulum involving 38 students (19 pairs) at the residential school in 1995. Specially designed questionnaires given to students before and after the experiment were administered to collect data both on the students' attitude to certain aspects of the simulation, and their performance. In addition, observation data collected included video and audio recording of students at work on the simulation to allow an investigation of how the students interacted with the software and to gain access to the conversations which the pairs had while using the simulation. This approach has been found to be particularly helpful in analysing the impact of educational software on learning outcomes. This evaluation was conducted as part of a University wide project run by the Computers and Learning Research Group investigating computer use in learning science and technology, and developing evaluation methodologies. It was both formative in that the evaluation results were used to redesign the notes guiding students through the activities, and summative in that we were able to draw some conclusions about the role played by the simulation in students' learning. In particular we were able to investigate the connections students make between real and simulated experiences and the role of graphical representations in developing students conceptual understanding.

The students were extremely positive about the contribution made to their learning by the program. There were learning gains shown by the improvement of the majority of students on the performance questions. However, the observation data suggested that many students remained unclear about the distinction between chaotic behaviour and motion that is merely *complicated*.

101 A collaborative system for computer assisted assessment based upon the World Wide Web

David Davies (Department of Physiology, The Medical School, University of Birmingham)

We have developed a system of computer assisted assessment that fully exploits the collaborative potential of the Internet and World Wide Web (WWW). Our system, which runs on MedWeb, the WWW server in the School of Medicine at the University of Birmingham, is fully open in that it benefits from the cross-platform nature of most Internet applications and members of the higher education community anywhere on the Internet can take advantage of its functionality.

The MedWeb assessment facility can be used to administer, deliver, and mark a variety of different question styles including multiple choice questions (MCQ), short answer questions and short-type clinical cases. Each question, regardless of type, is stored in a relational database in a format that allows for the exchange with most commercially available databases and question delivery systems. The database of questions can be accessed via prescribed tests or in response to a keyword search using any of the popular WWW browser applications such as Netscape or Internet Explorer.

The greatest strength of the MedWeb assessment facility is the ease of submitting new questions to the database and in designing prescribed tests. All question types can be added remotely, that is from anywhere on the Internet using a simple forms interface. This feature of the MedWeb assessment system creates enormous potential for institutional collaboration for undergraduate assessment. For example, an Internet-based assessment system such as that on MedWeb would allow a national subject-specific database of approved questions to be set up and administered through a single institution with easy access for every interested institution. We at Birmingham are already negotiating with several other UK institutions to coordinate a number of subject-specific assessment initiatives.

We have already used our assessment system in a number of formal undergraduate exams with great success. Each student was invited to complete an evaluation questionnaire following these exams enabling us to assess the attitudes of our students to such computer assisted assessment. Further details of these exams along with results of the evaluation questionnaires will also be presented during the demonstration.

120 TASMAT a computer-based tutorial and assessment system

Michael Paterson and Jean Cook (Glasgow Caledonian University)

The software developed in Authorware consists of a discipline independent shell and a discipline dependent bank of questions. Student users can select to use the system in either tutorial or assessment mode the tutor can create tests from the question bank. Student records in the assessment mode can be viewed and the performance of individual students on specified questions can be examined. Data from the student records can be manipulated using the access data base.

The question bank currently contains mathematics questions but could be extended to include questions from any discipline. Each question has an hint, a full solution and reference to appropriate learning materials.

203 The al-Khwarizmi equation problem page

Chetna Patel (Robert Gordon University) and Philip Adams (The Library, De Montfort University)

The Maths Learning Centre at De Montfort University created a WWW training resource for mathematics education. The educational input came from Maths Learning Centre Manager Chetna Patel with technical support form Philip Adams. The results can be found at http://www.dmu.ac.uk/ln/library/teams/eqhome.html

One of the tasks of the MLC Manager at De Montfort University was to explore various avenues for making mathematics support available to students. One option was to create resources that would be accessible over the World Wide Web. The intention was to:

- provide more access;
- introduce an interesting media for teaching;
- develop a network of interested parties.

The problems encountered included:

- difficulties of presenting mathematics in HTML;
- limited possibilities for interaction;
- limited access to the Internet open to students.

al-Khwarizmi and HTML

The Internet currently offers developers of World Wide Web Maths resources three unsatisfactory alternatives for working with maths. HTML 3.0 was developed to include codes for the display of mathematical expressions unfortunately most browsers cannot cope with these codes. The al-Khwarizmi equations are offered in text and image alternatives, though both these formats have disadvantages. Browser support for the HTML 3.0 maths codes might be a way forward, though Java and EqnViewer Applets offer useful tools for developers of Maths resources.

259 The use of Excel spreadsheets in assessment

Helen Watt (Staff Development Service, University of Glasgow, on secondment to LTDI, Heriot-Watt University) and Barbara Cogdell (Institute of Biological and Life Sciences, University of Glasgow)

This case study was undertaken by LTDI in conjunction with the Institute of Biomedical and Life Sciences (IBLS) at the University of Glasgow. Recently the overall course design within IBLS had been altered by modularisation and the resulting curriculum developed incorporated regular formative and summative assessment. In order not to overload staff and for students from large classes to receive feedback promptly, the marking of assessments had to be automated as much as possible. This was achieved using an Optical Mark Reader (OMR), a PC operating under a windows environment with Excel 5 and a laser printer.

The Optical Mark Reader was purchased to scan multiple choice assessment answers and course evaluations primarily for 1st and 2nd year courses. Although it has been invaluable for these tasks, the smooth operation of the OMR has only been accomplished after a considerable effort. It was not just a case of plugging in the machine, switching it on and hey presto all your exams are marked. It has been necessary to work out how to produce forms for the data that the machine would recognise, how to get the machine to actually read the forms and then what to do with the data that comes out of the machine.

Group 4

1 The French TLTP initiative at Queen's University Belfast

Peter Tame (Queen's University, Belfast)

Against the background of fast-changing pedagogical approaches that involve computer technology, the ICBL (Institute for Computer-Based Learning) at Queen's University Belfast has established a university-based consortium under the TLTP initiative, consisting of ten academic subject areas.

Queen's University is firmly and positively committed to developing, producing and employing high quality IT courseware to a wide range of disciplines. The languages project (initially French) in the TLTP scheme has produced planned courseware for a twelve-unit French grammar package, designed to teach and consolidate students' knowledge of the language.

The package has been used for the first time throughout this Semester (September - December 1995) with approximately 200 Level 1 students using it daily. There is one class session of one hour timetabled over ten teaching weeks, followed by a full hour (at least) of private study every week to consolidate tuition.

With ever-greater numbers of students taught by a relatively small number of staff in French Studies, the need for computer technology (CALL) has never been greater. Learning and revision of language is shifting from book- and paper-base to screen-based programmes which can provide the necessary enhancement and enlivening of otherwise routine, and even boring, learning strategies.

The aim of this paper is to describe the necessary strategic changes in pedagogical methods for which we as a team (academics and ICBL) are attempting to cater, and to illustrate these with some relevant examples taken from Queen's University's TLTP French programme that is currently being developed and that is almost completed.

The French programme (PROF - *Programmed Revision of French*) is designed with maximum structural flexibility in mind for use either as a stand-alone package for independent and group tuition, as well as for distance learning. It constitutes a genuine attempt to come to terms with new pedagogical parameters and a swiftly-changing education scene.

14

World Wide Web-based delivery for languages courseware

William Haworth (School of Modern Languages, Liverpool John Moores University)

Rapid development of the World Wide Web is offering new teaching and learning possibilities for languages. This paper examines the state of what is currently available, and what developments are under way, with particular reference to current work being undertaken by the author.

Although a relatively new arrival in the field of educational technology, the World Wide Web has already proved itself as an enormously successful platform for non-specialist access to textual and graphical data. Continuing rapid technical advances are already offering the chance to go beyond this. Increasing bandwidth, better compression algorithms, cheaper and easier network access, multimedia as standard and higher-performance computer hardware are combining to create a virtuous circle enabling fast general access to a wide range of data types. Sound is now readily accessible; video, increasingly so. The types and quality of feedback to the user are growing and improving.

Various aspects of Web-based courseware (existing and potential) are examined from the points of view of (a) technical feasibility and (b) pedagogical desirability. These are:

- types of materials amenable to Web-based delivery;
- impact on course structures;
- access - problems and opportunities;
- feedback - formative and summative - to student and teacher.

The author set up some of the first UK-based specialist World Wide Web pages for Modern Languages in July 1995 (http://www.livjm.ac.uk/language/). He is currently involved in Web-based courseware development for modern languages, and is working on materials for Beginners' Spanish.

35

Languages for all and software for all?

Christopher Jones (Department of Languages, The Manchester Metropolitan University)

The University Wide Languages Programme (Uniwide) at the Manchester Metropolitan University caters for the language learning requirements of many hundreds of students. As one hour per week of this course is devoted to a directed self study programme, much attention has been paid to the use of self access materials in a modern languages study scheme. An integral part of this self study programme is the use of computer based learning (CBL) materials. In addition to commercially available software the scheme makes use of CBL materials which have been designed specifically for Uniwide. The major CBL project in the Department of Languages over the last few years has been Gertie (originally from German Tutorial Interactive Environment) which was designed with the needs of the Uniwide programme in mind. The original pilot project provided a multimedia environment in which it was possible to teach and test German vocabulary. Since then the project has expanded to the stage where it now covers hundreds of items of vocabulary, many different subject areas, and the four modern languages in the Uniwide scheme (French, German, Italian and Spanish). This presentation will be a case study of the development and integration of a major in-house CBL project.

162

French grammar for experts: CALscribing the future

John Parkin (University of Bristol)

CALSCRIBE as devised by the Educational Technology Service at Bristol is an in-house TOOLBOOK template designed for the production of routine computer-based learning tasks in many disciplines. The exercises I have drafted form a number of modules explaining and testing points of French grammar. They are intended for use from first-year to final-year level of our BA course and are of three types.

The first type supplements an in-house grammar course known as Language Skills Development compulsory for all first-year students who fail an elimination test: the modules follow chapters in a written dossier giving basic instruction in French grammar. The second type supports a similar dossier for second-year students for whom the LSD course is compulsory. The material for final-year students covers incidental points of grammar which have emerged as problematic at that level.

The modules involve simple explanations followed by displayed examples plus drill exercises of three different types: free response (where the student types in a reply), multiple choice (where the student indicates whether a certain statement is true or false) and *pick-from-list* (where various possibilities are offered from which the correct version is chosen).

The modules are loaded on servers connected to two teaching labs of 10 Viglen 486 PCs and are the subject of introductory sessions open to all on a reservation basis. In addition they can be used for open access learning at any available time and can also be output onto floppy disk for home use.

Modules cover irregular verbs, article usage, adverbs, subjunctives, adjectives ending in -al and reflexives: a selection will be demonstrated. However response questionnaires indicate other areas where students require help, hence the list is ever-expanding in its intention both to help those beginning a degree course involving basic grammar and to plug gaps for those approaching finals after four years of advanced grammar who still find themselves in problem areas.

One cannot say that CALSCRIBE is the future. One can say that it is helping to chart the future of an integrated system of language learning at BA level.

189 A case study of developing computer assessment of writing skills

Paul Bailey (Technology Supported Learning, University of Plymouth) and Brian Chalkley (Department of Geographical Sciences, University of Plymouth)

The package brings together two major developments: the new emphasis on transferable skills, and the new priority given to the use of technology in teaching, learning and assessment. It has been used successfully with 150 students in the Department of Geographical Sciences on the first year Transferable Skills module.

The Transferable Skills modules have been developed over a few years, as the need for skills development has been seen as an increasingly important part of the degree programme. The increase in numbers of students has made assessment more difficult, hence the decision to write a computer based assessment package which would be a part of the writings skills programme.

The assessment package is written in Multimedia ToolBook, to enable more sophisticated and flexible assessment exercises to be undertaken. The exercises are marked automatically and the results recorded electronically to a file on the server. The results have been analysed to look at how students performed in individual exercises and also compared with results from a paper based creative writing skills assessments.

The package has proved a valuable experience in assessing student response to computer based assessment and the practical issues involved for both staff and students.

191 Increasing student motivation through the use of software packages

Paul Bailey, John Stainfield, Roger Catchpole, Jonathan Smart and Brian Chalkley (University of Plymouth)

Over the past couple of years we have developed a number software packages whose main objective has been to motivate students (and staff) interest. These computer based applications capture the imagination of both staff and students, making learning (and teaching) a more enjoyable experience.

To demonstrate this I have a selection of software packages, used in programmes of study at the University of Plymouth. They are:

Skills Shop: an interactive computer based introduction to learning skills;

Bihari Farmer: a computer based simulation of the life and death decisions faced by a rice farmer in the Bihar, India;

Remembrement: a simulation of the process of land fragmentation and reorganisation in a small French farming community;

Africa in Crisis: a interactive simulation which investigates the effectiveness of different measures in combating famine in Africa;

Virtual Field Trips: interactive field trips of Malta and Dartmoor which inform and test students, and prepare them for their visit to the field trip area.

All the packages are designed to be used as a resource to enhance the learning experience and are used as a part of a wide and varied teaching programme.

Group 5

42 Developing interactive multimedia case studies at Aston

David Crowther and Matt Davies (Aston Business School, Aston University)

Current teaching paradigms acknowledge that the use of case studies in teaching provides a means of integration of knowledge acquired by students, through the various teaching mechanisms employed, and of addressing the higher skills identified in Bloom's taxonomy of learning. The advent of multimedia into the teaching environment as a vehicle for delivery of learning material has provided an opportunity, by recognising the differential advantage which the use of multimedia gives to the teaching process, to maximise both efficiency in the teaching process and effectiveness in the student learning process. It is further argued that through the use of case studies delivered via a multimedia platform maximum benefit can be derived from the capabilities of the medium and that this delivery mechanism both facilitates active learning and experiential learning as well as being fully consistent with the student centred approach favoured by current teaching paradigms.

The presenters describe their current experience of developing case study material for delivery via multimedia technology, and the program set up to produce multimedia case studies as an integrative learning vehicle. They argue that using case studies in this environment is both technologically more cost effective to achieve than designing knowledge transfer courseware and makes better use of the technological capability of the medium for achieving both efficiency and effectiveness in teaching and in student learning. They conclude that this route provides the way forward for rapid courseware development and for fully integrating multimedia technology into the teaching process.

The presenters will demonstrate a multimedia case study which they have developed, which addresses a variety of management accounting and strategic management issues, and will outline their current and future developments in the area of multimedia case studies.

135 Commercialising TLTP courseware

Peter Davies and Timothy Brailsford (Department of Life Science, University of Nottingham)

The Biodiversity Consortium is a network of 40 UK universities (plus a number of overseas affiliates) committed to revitalising the teaching of biodiversity in mainstream bioscience degree courses using interactive multimedia technologies.

After three productive years of courseware development funded by the Teaching and Learning Technology Programme, the Consortium received additional funding to develop a commercialisation strategy that would ensure continuing support for the Consortium on a self-sufficiency basis. The income-generating strategy proposed was a combination of *contributions* from Consortium members and sales revenue from adapted or newly developed products.

In June 1995, the Consortium teamed up with Ransom Publishing Ltd and launched *Biodiversity 2000*, an electronic publishing programme dedicated to environmental education in the tertiary and secondary sectors. The first product in the series, launched in November 1995 to wide critical acclaim, was *Sonoran Desert: A Multimedia Field Trip to the Cactus Desert of Arizona*. Three sequels will be launched in 1996: *Lost Animals* (about species that have become extinct during the 20th Century), *Worlds of the Reef* (a virtual field trip to the coral reefs of the Caribbean) and *Vipers* (a comprehensive biomedical database on an important and fascinating group of snakes). All these products (in one form or another) will be on show at the Conference.

151a Desktop multimedia communication

Jim Mullin and Anne-Marie Fleming (Department of Psychology, University of Glasgow)

The Multimedia Communications Group (MCG) at the University of Glasgow host the Scottish MICE National Support Centre, funded by the Education and Research Network Association (UKERNA), and the TASCMAD project, funded by the Scottish Higher Education Funding Council (SHEFC). Both these projects have a remit to disseminate information concerning desktop multimedia conferencing facilities to the academic community.

MCG will demonstrate the use of public domain desktop conferencing tools supported by MICE-NSC and TASCMAD. Delegates will be able to participate in hands-on sessions of multimedia conferencing using shared audio, video and applications. Delegates should be able to communicate with remote participants on Clydenet and SuperJANET. In-depth information leaflets on follow up support for interested delegates will be provided at the sessions.

Posters will describe applications projects, especially education related projects in which these tools are being used.

151b Live demonstration - conference multicast

Jim Mullin and Anne-Marie Fleming (Department of Psychology, University of Glasgow)

The Multimedia Communications Group (MCG) at the University of Glasgow host the Scottish MICE National Support Centre, funded by the Education and Research Network Association (UKERNA), and the TASCMAD project, funded by the Scottish Higher Education Funding Council (SHEFC). Both these projects have a remit to disseminate information concerning desktop multimedia conferencing facilities to the academic community.

With the agreement of the ALT-C organisers, MCG will transmit live audio, video and slides of selected conference sessions onto the Internet. This *multicasting* as it is called will enable distant participants who have Internet Mbone connections to become virtual delegates at ALT-C 96.

161 The relevance of a user friendly interface in a multimedia language course.

Ana Gimeno Sainz (Departamento de Idiomas, Universidad Politecnica de Valencia, Spain)

This paper aims to defend the importance of a user-friendly interface to enhance the language skills presented in a multimedia language course. The strategies used to achieve motivation on behalf of the user will also be discussed as one of the results of a coherent interface.

The elements developed by the CAMILLE Project team in Valencia in order to achieve an efficient interface include:

- sound;
- music;
- positive/negative feedback;
- graphics design;
- sense of humour in illustrations;
- icons;
- animated pictures;
- easy access to exercises;
- colour coding navigation;
- higher/lower level navigation;
- video;
- location and design.

Each of these elements will be analysed in relation to their adequacy and cohesion with the linguistic content included in the course. This paper will be illustrated with a demo of courseware developed at the Universidad Politécnica de Valencia, *Español Interactivo*, for learners of Spanish as a foreign language. The paper will also approach the issue of integrating CALLware for ERASMUS students completing their studies at the University.

247

Interactive pronunciation

Don Friend (University of St Andrews)

The ELT Centre, St Andrews University, has developed an interactive computer program for the improvement of pronunciation skills for learners of English. The program has four stages.

Stage 1: The phonemic alphabet in English

1 The users learn to recognise the sounds of the phonemic alphabet and their corresponding letters. They click on a letter to hear its sound. Their ability is then tested in a number of ways:
  - vowel/consonant sound and word recognition;
  - transcription from phonemic into Roman script;
  - connecting words with their vowel sound component.

2 The learners work on their ability to produce the correct sounds; in pairs - one student wearing headphones hears each sound being tested, and then has to reproduce the correct sound so the other student knows what to select as the correct answer.

3 The students learn to combine phonemes to make words. They see a list of words and must record their attempts which are compared with model sounds.

Stage 2: Similar sounds

The learners hear two words spoken together and must click on a grid where these words meet. This is made difficult by the fact the student needs to distinguish between such pairs as *sit* and *seat*, *forty* and *fourteen*. There are twelve combinations of pairs/groups.

Students can practise producing the problem pairs in the same way as stated above.

Stage 3: Connecting speech and weak forms

1 The students work through a tutorial which covers linking, omission, assimilation and weak forms. They repeat the examples they hear. They are then given 25 sentences scripted phonemically and transcribed authentically.

2 They transcribe each sentence into Roman script. Then they hear each sentence modelled for them as well as each individual word. Then they select the word that carries main focus stress. Finally they record the sentence and compare it to the model.

Stage 4

At present, Rhythm/Stress/Intonation is dealt with by other means, though a computer program is planned for the near future.

This program is used as part of multimedia lab work at the ELT Centre, St Andrews University and in the Self-Access Centre.

Group 6

154a

The STELLA Project teaching software demonstrations

Jean Anderson (University of Glasgow)

Our aim at STELLA is to examine the applications of computers in tertiary-level English teaching and to develop software in the broad area of English Studies. Three departments are involved in STELLA: English Language, English Literature and Scottish Literature.

English Studies encompasses a wide range of types of subjects. The interests of teaching staff involved in the project range from language teaching and linguistics to the formal and conceptual properties of texts in English and Scots.

The teaching software to be demonstrated includes *The Basics of English Metre*, *Grammar Drills*, *English Grammar: an Introduction*, *A Guide to Henryson*, *A Guide to Piers Plowman*, and *The Essentials of Old English*. Other packages to be shown are *The Apostrophe*, *Spelling and Spelling Reference from ARIES (Assisted Revision in English Style)*, and *A Guide to Scottish Literature from 1350 to the Present Day*.

199

Avoiding the gaps: the Open Learning Centre, providing a unified approach to supporting teaching and learning technology

Jane Williams and Cathy Hole (University of Bristol)

Together, the Computing Service, Library, Educational Technology Service and Staff Development of the University of Bristol provide a wide range of high quality IT services, training and facilities as part of its Information Technology Strategy. However, the increasing pace and change in technology, together with limits on human resources have made it all too easy for academic teachers to be passed from one central support service to another and *fall down the gaps*. In recognition of this, the University, with support from its Teaching and Learning Group, established an Open Learning Centre (OLC). Based within the Library, the OLC provides a facility where members of staff can have access to self-paced learning and training materials to support all University activities. Among other things, the OLC provides a central point where teachers can take the first steps to embrace technology in support of their teaching responsibilities. Examples include the use of electronic mail to communicate with students, provision of core materials via the World Wide Web, use of presentation software to support lectures, or the development of interactive tutorials and case studies using multimedia authoring tools.

However, it soon became apparent that in addition to self-paced materials human resources were also needed. As a joint initiative the central services have raised funds to appoint an IT and learning technology advisor to act as a first point of contact to assist with the implementation and appropriate use of technology in teaching. The IT advisor is able to provide cross service advice and guide teachers to the appropriate resources and is thus able to help teachers *avoid the gaps*. The IT advisor is also in contact with the departmental teaching and learning advisors and those teachers taking the Teaching and Learning Course; a course mandatory for all new University lecturers. Other activities include the production of a beginner's guide to teaching and learning technology, evaluation of computer based training materials and educational software, and, more long term, the development of case-studies involving a number of lecturers employing various technologies. Such case studies provide first hand knowledge for lecturers new to teaching and learning technology. These case studies involve interviews with both teachers and students and provide information on what works and what doesn't.

This paper will discuss the various strategies outlined above, how these relate to the overall provision of teaching and learning services within a research based University and present the outcomes of the initiative 10 months on.

233 Question delivery over the World Wide Web

P Browning (Department of Geology, University of Bristol) J Crisp, J Williams and K Whittlestone (Educational Technology Service, University of Bristol)

The Educational Technology Service (ETS), University of Bristol, provides support to academics wishing to use technology in their teaching and has several years experience of delivering question and answer material to students using computer systems. This experience has culminated in the development of a number of tools to assist the production and delivery of questions. Two such tools are CALScribe for use on Windows based PCs and the Tutorial Markup Language (TML) for authoring material for use over the World Wide Web.

CALScribe is a Windows based authoring template developed using Asymetrix ToolBook, a major authoring package. CALScribe provides a number of interactive question and answer screens, as well as a framework for instructional and screen design. Scores may be associated with each question, the final score being displayed at the end of the tutorial. CALScribe allows the author to produce tutorial and question and answer material readily and is now being used in several departments at the University of Bristol and other Universities for a wide range of subjects.

The development of the World Wide Web has provided an opportunity to develop learning material across a number of hardware platforms and therefore a format for marking up question sets for delivery over the network was developed - the Tutorial Markup Language. In addition export facilities within CALScribe are being developed to enable authors to export CALScribe material to a TML format.

TML is an interchange format designed to separate the semantic content of a question from its screen layout or formatting. The language is designed to support several different types of question within the same content model. It is essentially a super-set of HTML, with new elements added to describe question information. During the development of this format, a program was written to convert the information in a TML file to raw HTML which could be delivered to a standard WWW browser. This program is a CGI compliant program currently working with the CERN Web server.

240 The MARBLE Project: online demonstration

Jeff Haywood, Hamish Macleod and Mary Cuttle (University of Edinburgh), Patrick McAndrew, Roger Rist and Sarah Price (Heriot-Watt University) and Paul Dean, Ray Land and Eric Bonharme (Napier University)

MARBLE is developing innovative resource-based learning materials to be delivered across the powerful EaStMAN (Edinburgh and Stirling Metropolitan Area Network). It is funded by the Scottish Higher Education Funding Council and is a collaborative project between Edinburgh, Heriot-Watt and Napier involving over 40 academics from the three universities.

The projects are taken from a broad spectrum of academic areas and are designed to be exemplars of the different ways in which the World Wide Web can be used to enhance learning. It is hoped that these exemplars will encourage and motivate academics to become involved with the development of Web based resources for their own students. Approaches used include:

- delivery of course material;
- assessment;
- electronic student support;
- data interpretation;
- image manipulation;
- WWW- based student projects.

MARBLE explores the range of WWW technology available and exploits Netscape features such as frames, plug-ins, CGI scripts and Java. The areas covered include:

- Geotechnical Engineering
- Biological Sciences
- Psychology
- Interactive Vision
- Mathematics
- The Built Environment
- Computing
- Library Information Retrieval

The demonstration will give free access to all the materials developed by MARBLE including those which ordinarily have restricted access (http://www.marble.ac.uk/marble).

257 The design of computer based learning programs: a solution to the problem of reproducing teaching-learning acts through the computer interface

Marsden Bradshaw (Staffordshire University)

There are problems in the design of CBL programs which arise from the unsystematic, intuitive practices by which the tutor/author decides what learning activities students are to encounter. In short, the *hit-and-miss* approaches of traditional teaching, although perfectly adequate for the real classroom, are inadequate for CBL designs.

A solution lies in devising a curriculum design tool which the CBL designer can use to devise learning activities, with more system and certainty, which will engage the learner in those activities which will lead to understanding. The design tool consists of the operation of two analytical components in systematic relationship to each other. The components are:

A classification of 15 Graphical User Interface activities (opening and closing *windows*, moving stuff about on screen etc) which mirror concrete operational thinking;

B a comprehensive array of cognitive tasks, one or more of which the learner must perform in problem solving.

Group 7

138 A generic multimedia toolbox for interface design

R A Britten and R F Daffurn (Faculty of Science and Technology, Glasgow Caledonian University), G Burns (Department of Engineering, Glasgow Caledonian University) and W Sandham (Department of Electrical and Electronic Engineering, University of Strathclyde)

The use of multimedia based learning packages has been proposed as being crucial to the education industry's needs if it is to cope with projected rise in student numbers in the next century. With this in mind the Multimedia Research and Development Unit was commissioned by the University Learning and Teaching Committee to conduct a feasibility study to determine the possibility of constructing a generic multimedia interface that would, if it were successful, dramatically reduce development time for future CBL applications.

This paper will discuss the strategies employed in developing the interface and the approaches that determined the modular constructs used as the building blocks of the system. It will also discuss the choices made in the software chosen as the development vehicle and the consequential effects on cross-platform delivery.

A modular approach was adopted, as this was perceived as the most practicable solution to the differing needs of the academic departments who would use the interface. Some would have the requirement for the complete structure that consists of modules to handle text, graphics, sound, animations and digitised video with a built in linked navigation system, while others could *pick and mix* to fulfil their needs.

We shall highlight the bottlenecks and misconceptions that can arise from the errors in communication between the client academics and the developers and the strategies that have evolved to lessen the effect of these errors.

The approach that we shall discuss also lends itself to use across distributed networks such as the World Wide Web and this as this aspect of this project will also be discussed.

139 Technology based DSP education in Scotland

R F Daffurn, R A Britten and J Meldrum (Faculty of Science and Technology, Glasgow Caledonian University), N Cameron and W A Sandham (Dept of Electronic and Electrical Engineering, University of Strathclyde) and A J Anderson (Dept of Electrical and Electronic Engineering, University of Paisley)

This demonstration is directed at all higher education institutions (HEIs) within Scotland who currently have, or who are developing technology-based digital signal processing (DSP) courseware. These include the Universities of Strathclyde, Edinburgh, Dundee, Aberdeen and Heriot-Watt, amongst others. Companies will also be invited, most notably Texas Instruments, Motorola, LSI and Burr-Brown.

Representatives from each institution/company will be available to demonstrate their respective DSP courseware developments and/or products.

The demonstration should provide an ideal forum for delegates to obtain hands-on experience with a variety of different technology-based DSP courseware. Other issues which will be addressed are costs of integrating technology into an undergraduate/postgraduate curriculum, assessment of students learning, and course evaluation.

175 A computer aided learning package for teaching structural design

C MacCallum and R Hanna (The Mackintosh School of Architecture, Glasgow)

The teaching of structures and its design integration has always been seen as one of the major problems in design education in schools of architecture worldwide. A number of suggestions have been put forward to improve the quality of teaching in structures in architecture. These include the production of computer based learning materials, and the use of the computer as a *substitute* tutor.

This paper reports on a SHEFC funded project jointly carried out by the Department of Civil Engineering, University of Paisley and the Mackintosh School of Architecture. The project aims to build a computer-assisted learning package on the response of structures to load. The software will be used as an interactive teaching tool for both architectural and engineering students.

The package has three levels: Beginners (1A), Intermediate (1B) and Advanced (T). The first two levels have been completed after continuous feedback from both institutions. Level 1A is geared towards architectural and engineering students to help them understand structural behaviour of building components, such as deflection. Level 2B enables students to draw precisely the structure of their designs, assign materials, and specify section properties of structural members. Level T is aimed mainly at architectural students where they can design and analyse realistic structures by choosing structural members from a library, specify materials and multiple loads.

The software package will be appraised by students prior to its final release. The outcome of this project will promote and enhance students' understanding of the response of structures to load; it will also help students grasp the impact of varying building materials and cross sectional properties on the structural forms.

209 A CAL package for undergraduate quantity surveyors

Vian Ahmed (Dept Civil Engineering, Loughborough University)

Quantity Surveying is a profession which encompasses civil and building engineering and focuses in many respects on the quantification and measurements that ultimately underpin the financial integrity and viability of the construction process. Bills of quantities have for many years been the instrument that provide a quantity and financial breakdown of contract prices. The introduction of design and build does to some degree dispense with a contractual bill of quantities but in order to understand the financial scope of a contract bills are often prepared and as a result will form the backbone of quantity surveying teaching for some years to come.

Over the years a number of computer packages been developed in order to assist quantity surveyors with the process of estimating and producing their bills of quantities.

Most of these packages are designed for quantity surveyors who already possess the necessary practical skills and experience and are not designed to perform in an educational role. There are no programs that attempt to educate the undergraduate quantity surveyors in understanding the measurement rules from first principles. One of the main stumbling blocks in teaching measurement is that a student needs to have an understanding of the construction technology process before he can begin to understand the measurement rules that govern the quantification process. This leaves the student facing a problem of not being able to break down the construction process, due to their lack of construction technology knowledge, into the elements that the measurement rules are based upon. This presents major problems with undergraduate module curricula.

In order to address this issue, a prototype multimedia package been developed at the Department of Civil and Building Engineering in order to assist first year undergraduate quantity surveyors in their understanding of the first principles of the measurement rules in quantity surveying by superimposing the measurement rules onto construction technology. The computer package illustrates two exercises that guide the students step by step through the bill of quantities, by breaking down each element of the bill of quantity, and providing the students with construction technology information such as drawings, pictures and animation including site video clips where appropriate.

This CAL package is expected to enhance the student's understanding of measurement rules and how they relate to the construction process and provide a greater teacher-student interaction which will also provide an enjoyable way to learn what is a very complex series of procedures.

195 A demonstration of several strategic institutional CBL projects

Lawrence Hamburg (Learning and Teaching Institute, Sheffield Hallam University), Peter Hartley (School of Cultural Studies, Sheffield Hallam University) and Alison Hudson (Centre for Multimedia in Education, Sheffield Hallam University)

A demonstration of several major institutional courseware projects which together provide CBL materials for use by all students at Sheffield Hallam University. Teams of staff from the University's Schools, Learning and Teaching Institute, Library and Learning Resources and Computer Services are involved in the development, integration into course programmes and delivery of these projects. Software to be demonstrated includes:

- customised TLTP materials in Engineering (CALGroup) and Economics (WinEcon);
- the conversion and updating of Apple Mac materials onto a PC Platform (using Toolbook) covering Communications studies eg essay and report writing and the conversion of paper based skills pack materials;
- case study CBL material using the construction of the University's new £14.5 million Learning Centre as the basis for the source material;
- ERIS (Electronic Resource Information System) as a resource for accessing databases and other electronic materials available in the new Learning Centre.

The demonstrations will enable comparisons to be made between different approaches to the development and integration of CBL into course programmes, ie including the use of existing TLTP materials and in-house development of other CBL materials.

253 Software course structure

Bill Tait (Department of Mathematical Sciences, University of East London)

A course may be regarded as the delivered version of a syllabus which is, in turn, an academic view of a subject area. A course describes the order in which the various topics are presented to the learner, while the syllabus defines the relationships between the course components, in terms of prerequisite studies. The subject area is the target, and the eventual knowledge base to which the learner aspires. All three can be described as object oriented structures and implemented in educational software.

Courses are normally delivered as lists, showing the order in which topics are to be delivered. Personally taught courses and books are typically in this form, and software courses can be similarly designed by using buttons to move between adjacent pages. Syllabuses are often described as flowcharts, or tree structures. These are less adaptable to the constraints of personal tuition and books, but are readily implemented in software. In this case, navigation between topics is effected by means of hypertext links. Subject areas are defined by logical rather than educational relationships and may be described as maps. These can also be used by software courses, but the mechanisms for doing so are not well established.

There are some advantages to be gained by designing a course structure to resemble that of the relevant syllabus. This is appreciated by software designers, who use hypertext, and similar structures, in tutorial software. It probably helps to orientate the learner, facilitates conceptualisation and improves motivation. It is interesting to examine the use of maps in educational software, as a means of moving even closer to the structure of the parent subject area.

The present study looks at the use of lists, trees and maps in the design of educational software and demonstrates the effects with a short course on the Internet.

TUESDAY 17 SEPTEMBER 0900-1045

Group 10 NEW DEVELOPMENTS

66 Factors affecting the quality of learning materials on the World Wide Web

Terry King (Department of Information Science, University of Portsmouth)

A survey of learning materials available on the World Wide Web (WWW) suggests that much of the content has a low level of interactivity, offering the user control of pacing and sequencing, with the learner browsing in an undemanding hypertext environment. This paper will deal with the factors which affect the quality of learning materials on the WWW and the extent to which the learner can be fully engaged in active learning on the Internet.

Considering educational methods from the point of view of the new educational paradigm of student centred, teacher facilitated learning, the paper will examine in detail what is meant by interactivity in learning materials and establish just how much of this new paradigm can be delivered currently on the WWW. It will draw on specific examples of Web-based courseware, simulations and media selection, and will go on to consider new developments like the language Java, the Virtual Reality Mark-up Language (VRML), Microsoft Internet Studio and products like Shockwave, and discuss the impact these will have on interactivity of learning materials. The paper will also outline how the easy availability of simple multimedia effects is encouraging experimentation with radically different learning techniques, such as Accelerated Learning (AL) with specific examples of such Web courseware developed at the University of Portsmouth.

The paper will go on to consider alternative educational environments that are emerging on the Web such as graphical Multi-User Domain (MUD and MOO) interfaces, using specific examples such as The Palace, and discuss how these and the impact of convergent technologies (like email, and real-time audio and video) are revising the environment in which the learner operates on the WWW. And, furthermore, how these have the potential to both increase interactivity and reduce the isolation of the learner.

148 Clyde Virtual University

Linda Creanor (The Library, University of Glasgow), Niall Sclater (Computer Centre, University of Strathclyde) and Dave Whittington (Computer Science, University of Strathclyde)

Technology in teaching and learning is now an accepted fact. The kick-start given to research and development in IT in education by the Higher Education Funding Councils through TLTP is having its effect as more software becomes available and its use and effectiveness is clearly documented. Problems still remain however, including practical difficulties in installing and upgrading software packages, distribution and dissemination.

Now the infrastructure is in place to allow us to move on to the next logical step - to deliver platform-independent multimedia software via the World Wide Web. The greater bandwidth of the Metropolitan Area Networks (MANs) facilitates the speedier download of graphics, sound and video files, and Clyde Virtual University (CVU) is one of many projects funded by SHEFC to exploit these possibilities.

One of the main aims of CVU is to convert existing pieces of courseware including CAL packages originally developed in authoring software such as Toolbook and Authorware, lecture notes and graphics in various formats, along with its own assessment engine, for delivery over the Web.

After registering at the virtual Administration Office, students can enter the CVU Lecture Theatre and select courses from an appropriate subject area. They can search for information in the Library which contains academic papers, links to the OPACS of universities on the ClydeNet MAN, and documentation on the background to CVU development. Their chances of success can be improved by working through the Library and Study Skills modules. When they are ready, they can enter the Assessment Hall and test their knowledge using a variety of interactive assessment exercises. If they feel the need for relaxation after this frenzy of academic activity, they can retreat to the Virtual Cafe where they have the opportunity to meet and chat with fellow students and tutors in a more informal setting.

CVU is intended to gain its own momentum and continue to expand, thus providing an innovative and useful resource for the local academic community for many years to come. As one of the first virtual university projects in Europe to receive funding, it is rapidly gaining in interest to all involved in the delivery of multimedia courseware, reference material, assessment and student discussions over the Internet.

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Building, integrating and sharing WWW-based learning materials - the MARBLE project in Scotland

Jeff Haywood, Hamish Macleod and Mary Cuttle (University of Edinburgh), Patrick McAndrew, Roger Rist and Sarah Price (Heriot-Watt University) and Paul Dean, Ray Land and Eric Bonharme (Napier University)

The use of the World Wide Web (WWW) for enhancing learning has caught the imagination of many academic staff in higher education, probably for these reasons:

- independence of platform (PC, Mac, UNIX);
- delivers from single machines without software licences;
- offers exploration or delivers specific materials;
- is becoming increasingly interactive;
- programming is relatively easy and others' materials can be converted.

However, it is also clear that many developers of Web-based learning materials are those same people involved in producing conventional CAL courseware, and that, although there are newcomers, many staff show the same reluctance to become involved, for whatever reasons.

In summer 1995, the Scottish Higher Education Funding Council sponsored an initiative to promote the use of the high-speed Metropolitan Area Networks (MANs) linking all HEIs in Scotland. We successfully put forward the MARBLE Project (MAN Accessible Resource Based Learning Exemplars) which has six aims:

- to provide exemplars of how the WWW can be used to create resource-based learning materials for students;
- to provide these in a range of subjects;
- to deliver those materials as integral parts of courses;
- to share them between courses at several HEIs;
- to create simple examples and those which push current boundaries;
- to reflect on team experiences during the project and convert this into staff development materials to enable others to follow us with greater ease.

MARBLE is a collaborative project between Napier, Heriot-Watt and Edinburgh Universities, and three project officers, one at each site, work with small teams of academic staff from each university to develop materials, deliver them to students, evaluate them and help produce the staff development guides.

The presentation will demonstrate some of the products of MARBLE and examine how they have been used, often very successfully, within courses, and also look at the evaluations. The lessons learned from the project about ways of enabling and supporting collaborative teamwork between academic staff in several HEIs will be explored.

Group 11 EVALUATION

9

Fully integrated computer assisted language learning: mission accomplished

Brian McCarthy (Dept of Modern Languages, University of Wollongong, Australia)

This paper documents a project conceived some five years ago in the Department of Modern Languages at the University of Wollongong (Australia), and progressively implemented over the past three years. It involved the preparation of a series of Hypercard-based exercises that would give students the opportunity to master and to maintain mastery of basic French grammar points more efficiently and more effectively than is possible in a classroom environment, and at the same time relieve some of the pressure on class time in a seriously overloaded teaching program. By looking in detail at the structure of a completed task rather than presenting a proposal or propounding a theory, the question it answers is not *"How do you think computers can be used successfully in language courses?"*, but *"How have you used computers successfully in your language courses?"*. It examines the academic context, pedagogical and learner needs and constraints, the CALL materials involved, the program of implementation (ie the structure that removed the work from the classroom while keeping it woven into the fabric of the course as a whole), patterns of student use of computers and measurement of student performance.

The average score for groups even at the beginner level is almost invariably higher than 80%, and although no class time is devoted to reviewing grammar points after initial presentation, performance continues to improve over the 3 years. For every grammar point, the class performance was better at the end of the course than when it was fresh in the student's mind and the focus of class activities.

The project has clearly demonstrated that computer technology provides students with a superior means of maintaining grammar essentials than was previously possible, and that success is dependent not only on finding (or creating) appropriate materials, but on careful planning and monitoring of their integration into the teaching program. The materials have already been adopted by some 20 universities nationally and internationally, and almost 100 secondary schools.

155 Computer assisted language learning applications: the case of the changing shell

Pepi Sarvary (STELLA, University of Glasgow), Erica McAteer (Teaching & Learning Service, University of Glasgow) and Mike Harland (Hispanic Studies, University of Glasgow)

In the development of computer assisted language learning applications (CALL), a high value has been placed on the concept of a program shell. The theory behind this concept was that the programming was difficult, time consuming and required specialist knowledge. A shell would be a container into which lecturers and course designers with no programming knowledge could place their material. Material could then be changed and updated as required without further need for a programmer. Over the last few years, however, both the definition of a shell and the role of the shell have been changing and are still in a state of change.

In the wake of unprecedented developments in computer hardware and a proliferation of comprehensive authoring packages it is not surprising that the most recent CALL packages are far more ambitious projects than their predecessors. The courseware is in the process of developing from a small tool, useful to illustrate a particular point, to being an integral part of the course work.

The complex, episodic program *De Tudo Um Pouco*, designed as a integral part of a Portuguese basic language course and funded by TLTP, will be used to illustrate the ways in which the shell concept has developed and changed and is currently being successfully used in the new interactive, multimedia environment.

The successful translation of the Portuguese *De Tudo* into the Spanish *Poco a poco* will nevertheless be used to illustrate the limitations of the shell in its present form. Future modifications to the shell concept will be required to meet the expectation levels of a new computer literate student intake in an environment where a computer component will form part of most, if not all, of their courses.

156 From book to hyper-ToolBook: bridging the gap to teach language, history and society

Marina Orsini Jones (Centre for Information Technology in Language Learning, Coventry University)

The paper will be based upon the evaluation of the integration into the curriculum of the in-house produced hypermedia courseware, *La neve nel bicchiere*, based upon the book with the same name, by the author Nerino Rossi, at Coventry University.

It will highlight the suitability of hypermedia to teach multi-disciplinary subjects - such as Italian language and society - to undergraduates on a BA Honours Degree in Modern Languages in a *new* university.

It will furthermore show how the students' performance in seminar presentations and essay-writing has improved following the introduction of hypermedia, contrasting it with their work based upon the same book before the courseware was available to them.

Moreover it will stress the *work-in-progress* nature of the project *La neve nel bicchiere* and how the courseware is changed and customised to students' needs and constant monitoring of their feedback. It will also stress the importance of tailoring the courseware both to students' needs and to the needs of colleagues in other universities, to avoid the *not-invented-here* syndrome, were the package to be available on the market in the future. It will show how the feedback from other colleagues was obtained and evaluated in order to improve the courseware.

It will show how students can gain confidence and transferable skills by using IT based materials for a subject which has traditionally been linked to the humanities.

The paper will finally warn about the backlash against technology in education which is beginning to creep into the world of education in the UK and show that hypermedia can be successfully introduced into the curriculum permitting lecturers to do things they would not be able to do without it.

Group 12 EVALUATION

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Evaluating the delivery cost of technology-based and traditionally delivered modular courses

Ian Marshall and Alan Milne (School of Informatics, University of Abertay)

In a period of financial constraint in not only UK Higher Education but globally, staff and managers of institutions have to consider very carefully the cost effectiveness of the methods used to promote student learning. The current increase in popularity of modular course structures and a move towards increasing use of technology-based solutions have to be justified on the grounds of cost-effectiveness. The authors will present the results of research to develop a software tool which estimates the delivery cost of both technology-based and traditionally delivered modular courses.

Existing research into delivery costs of traditionally delivered and technology-based training will be presented briefly along with existing models of cost-effectiveness. An overview of research into learner time reduction for technology-based solutions will be presented before the underlying structure and assumptions of the software model are described.

The model produces estimates of staff delivery time resource usage in terms of monetary values and student staff ratios (SSR) based on fee income or full-time equivalent student (FTE) costs. The model produces *what if* calculations based on different combinations of lecture and tutorial group sizes or technology-based resource availability and allows the user to vary all the contributing parameters.

The results of informal evaluation with experienced institutional managers indicate that the model promotes a better understanding of the cost effectiveness of alternative delivery methods and allows them to explore the effect of alternative modular course structure on costing assumptions. It has also proved useful in developing a fuller understanding of the inter-relationships between model parameters and measures of course cost. An interesting result is the identification of an upper bound to the SSR which can be achieved for a given course structure which is independent of class size. Future research and development of the model along with its extension to include development effort, non-staff and capital cost will be described.

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Investigating an integrated learning environment

Helyn Thornbury, Valerie Belton and Mark Elder (Department of Management Science, University of Strathclyde)

The MENTOR multimedia teaching modules have been in use in teaching at the University of Strathclyde for 3 years. The paper describes a study which investigated the relationship between student learning and a combination of different learning activities. The learning activities of the course studied included a substantial element of independent computer based learning (CBL) integrated with lectures, labs and assignments (both group and individual).

The research method was initially piloted on two separate classes, a 2nd and a 3rd year class of undergraduate business faculty students. Following this, a longitudinal study was completed on 25 MSc students completing a course in Visual Interactive Simulation. Data was collected at regular intervals during the four month period of the course. The data detailed the student's learning activities and their confidence in the subject area. It was base-lined before the course started and collected beyond the finish of the lecture course until the final exam.

The students' confidence was recorded using confidence logs which allowed them to rate their confidence towards a variety of learning and skills objectives associated with the course. The confidence logs provided information on the learning curves associated with different aspects of the course, on a student by student basis.

The students' learning activities were recorded using structured learning diaries developed through a pilot study. Both the diary and the confidence log were completed and submitted together. Details of the students' computer-based learning sessions were recorded electronically.

Combining the data from the confidence logs with the individual learning activities of the students provided a detailed picture of the development of their learning and the relative strengths and weaknesses of individual learning resources.

The research method which was employed is most commonly used over short time periods. The paper will report on the findings of this study and comment on the appropriateness of this method to longitudinal investigation.

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Integration from the students' perspective: factors that affect fit

Jennifer Hall (Department of Psychology, The Open University)

A number of studies have referred to the fact that the adoption of educational technology is unlikely to be a success unless its integration into the content and the curriculum are not given detailed consideration (Kirkwood, A 1995, Waterfield and Furber, 1992). This paper describes the factors that need to be taken into account to ensure a successful integration process. Students' discursive interview material used as an evaluative source has revealed much of what matters for the successful fit, implementation and integration of new technology into the curriculum. Students in their first year of higher educational studies in professional vocational degrees (medicine and engineering) were involved in using new technology that included hypermedia and multimedia CAL applications. Analysis of the educational environment can reveal likely mismatches (such as those lying between the pedagogical principles of assessment and those of the course material, or more broadly the educational environment) that will interfere with the process of integration. However the students' own views are wider, and their descriptions of their use uncover hidden costs, benefits, matches and mismatches in the integration process. Additionally, examination of students' perceptions have revealed individual differences that are not easily identified in any other way. The paper is concluded by providing an overview of the elements that are perceived of as having particular impact in the process of integrating new technology into the curriculum.

Group 13 EVALUATION

196

Evaluating the impact of WinEcon on teaching & learning of economics

Ziggy MacDonald (Department of Economics, University of Leicester)

This paper presents some findings of an evaluation project undertaken in the Department of Economics, University of Leicester, set up to determine the impact on the learning environment of integrating the WinEcon software into the first year curriculum.

The evaluation project was presented as an experiment in September 1995 when the WinEcon software was officially launched at the Computer Aided Learning in Economics & Business conference, held in Bristol. The intention was to create a scenario in which a sub-set of the course enrolment would be particularly encouraged to use WinEcon with the remainder of the course acting as a control. In the months that followed data was collected on the 240 students enrolled on the first year microeconomics course. Based on a model of learning (using exam performance as the dependent variable) we used qualitative analysis and logit & probit regression analysis in an attempt to isolate the effect of continued WinEcon usage on student performance. The results of this analysis will be presented and a model of continued evaluation suggested both for the institution and at a national level.

In the light of these results, the paper concludes by presenting a summary of the implications, *ex ante*, for the teaching of economics in the 1996/97 session, in which we envisage WinEcon replacing a number of tutorials and/or lectures. I will also introduce the next phase of the evaluation project, during which WinEcon will be more established in the course and the institution and our evaluation model will be more mature.

198 Learning from self-evaluating courseware

Li Lin Cheah, Simon Price and Phil Hobbs (Centre for Computing in the Social Sciences, University of Bristol)

WinEcon is a comprehensive computer-based learning package for teaching introductory economics developed by the TLTP Economics Consortium. It provides a unique and interactive teaching and learning environment from both the student's and lecturer's perspective.

One integral feature of the software is the ability to record the activities of WinEcon users within the package. These activities may simply be login and logout activities, or data relating to visits to the various tutorial topics. Further, data can be recorded from users' attempts at the self-tests and exam tests that are incorporated in WinEcon. This data includes:

- test data;
- user data;
- start and end times;
- number of attempts;
- results and grades achieved.

So, there is a wealth of information available in WinEcon to feed back to course administrators, lecturers and students. But how can this information be best utilised to improve the software by:

- tracking student's performance;
- informing the course administrators and lecturers about modes of use of the software and student learning practices?

This paper addresses these issues and presents the results of a study conducted during the implementation of WinEcon at the Department of Economics at the University of Bristol. Using the results of statistical analysis of data produced during the study the paper makes proposals for further research into the evaluation of interactive courseware packages.

223 Course software with workbook: using WinEcon in economics courses

Jean Soper (Economics Department, University of Leicester)

The WinEcon software developed by the Economics TLTP Consortium provides an interactive approach to learning economics for students on the first year of a university degree course. The WinEcon Workbook: Interactive Economics (Soper and Hobbs, expected 1996) offers students a guide to making the most effective possible use of the software. It includes questions which highlight the key results of economic analysis and encourage students to make structured notes on their work.

Increasing class sizes can be accommodated by larger lecture groups, but make it difficult for students to get individual help and feedback on their progress. The WinEcon software provides an interactive approach to learning economic analysis. The courseware is very flexible and allows students to choose either an acquisitive or inquisitive approach.

Preliminary evaluation results show many positive aspects of WinEcon, but suggest also that students are unhappy at simply being told to go and use WinEcon. Partly there may be some difficulty in computer availability, but partly also it seems they need a guide as to what to do with WinEcon.

The WinEcon Workbook has been written by the same team that created WinEcon. It helps students know what to expect when they begin using a particular part of WinEcon, and its questions are designed to get students thinking about key analytical points. When the answers are written down they provide a record of the main results that are useful for revision purposes.

Group 14 NEW DEVELOPMENTS

32 An online electronic journal for teaching purposes

Jack Meadows and Fytton Rowland (Department of Information and Library Studies, Loughborough University) and Penny Yates-Mercer (Department of Information Science, City University)

Electronic journals are rapidly gaining in significance over a range of subjects, but there is, as yet, little by way of training in their production or use. An experimental online electronic journal has therefore been established to allow for the training of students in the handling of such journals.

The journal is provided as a distributed activity: in the experimental stage, which has just been completed, *issues* have been produced at three node: Loughborough University, City University and the University of South Australia. The students involved in this activity were/are taking degrees in information, library, publishing or communication studies. The input material includes particularly thesis abstracts and student essays. As an outcome of the experiment, a training package is being assembled, the core of which can be made available online. The journal itself is available on the WWW. The material can either be used directly by other institutions or they can provide *issues* of their own.

The main training topics covered include inputting information; editing and refereeing; presentation and layout; dissemination. This material can be used in different ways on different courses: it has been evaluated with students ranging from first-year undergraduate to postgraduate. The results of the study offer an interesting example of how technology and course design interact when organising training in hands-on activities. In passing, they also throw some light on the likely expectations of readers of online journals, and on the problems they might expect to encounter.

86 Chadwyck-Healey's electronic home of the humanities

Julia Taylor (Commissioning Editor, Chadwyck-Healey Ltd)

Since 1989 Chadwyck-Healey has been publishing electronic databases in the humanities; reference tools which support the research and teaching communities of the world. In response to the opportunities afforded by new technologies and as a consequence of the limitations of the old, an innovative model for online searching has been developed. In December of this year the virtual library on the Internet will be launched. The primary component will be Chadwyck-Healey's full-text literary databases.

For the first time it will be possible to navigate from one text to another across the boundaries of individual databases and across the literary genres. The seamless linking of such data will enable the user to make connections never seen before; theories can be tested at a speed and with an accuracy unimaginable with printed works. Most importantly teachers will be able to compile anthologies and develop concordances from a huge range of authors, works and genres and tailor the material to the course they wish to teach.

In addition to the full text, the necessary tools of reference will be provided. The full-text databases will be linked to reference works essential to the study of literature such as dictionaries, bibliographies, chronologies, and literary companions. It will be possible, for example, to move from the text of a particular work into one of the bibliographies to consult the entry for the author.

By presenting the material in a single online environment, the virtual library creates unprecedented opportunities for research. As a resource for teachers and students, it will provide access to an enormous corpus of both primary and secondary literature. It will also be a gateway to all the material of relevance in the electronic community.

113 New technology for interactive CAL: the Origami project

Robert Harding and Steve Lay (Department of Applied Mathematics and Theoretical Physics, University of Cambridge), Peter Robinson and Richard Watts (Computer Laboratory, University of Cambridge)

The Origami project is a three year EPSRC project that forms part of a general research programme on human-computer interaction. The goal of this research is to investigate and implement new methods for human-computer interaction, and to apply and evaluate their use. The research centres on the DigitalDesk - an ordinary desk augmented with a computer display using projection television and a video camera to monitor inputs. The DigitalDesk allows electronic and printed documents to be combined to give richer presentation and interaction possibilities than are possible with either separate medium.

This paper will examine the implications of such a system for computer aided learning and, in particular, the use of printed documents with electronic augmentations. The increase in the use of computers to enhance the delivery of courses has not changed the fact that much student learning is still performed through the reinforcement of private study with printed materials such as course notes, work-books or simply standard texts. The Origami project strives to strengthen the link between these two activities by allowing the computer to interact with the student *through* these printed materials as well as through the more conventional mouse-driven windowing systems.

Two systems which demonstrate these possibilities are being developed and will be demonstrated in prototype form. The first concerns the WWW which is already being used to deliver educational materials. The DigitalDesk activates printed documents by allowing the student to follow hypertext links (using a physical pointer tracked by the system) to these materials while remaining focused on the original text. The second enables the computer to assess a sketch, drawn by the student into their work-book, by comparing the salient features with those of an ideal drawing. For example, the student is requested to draw a simple function of x onto a set of pre-printed axes and is marked on the correct positioning of local turning points and axis interceptions.

Group 15 CASE STUDIES

152 English (and Scottish) studies at STELLA (Software For Teaching English Language and Literature and its Assessment)

Christian Kay (STELLA Project, University of Glasgow)

With STELLA's 10th anniversary in sight, the time has come to review past achievements, the present state of the art, and likely future developments. New projects of particular importance for teaching, learning and research will be described in the other papers in this session. Both software and hardware have become increasingly versatile in the course of the decade. STELLA staples such as *The Basics of English Grammar* and *An Introduction to Old English* are on their third rewrite, moving from Guide Hypertext to Toolbook. A new suite of programs, ARIES (Assisted Revision In English Style), is being developed in stand alone and networked versions. At the same time, staff and students have access to an increasing range of digitized text and bibliographic resources on CD and over the Net, and text analysis software has improved in user friendliness. A huge demand for new resources is being created, and computer-based work is becoming increasingly adventurous in conception and execution. This last point will be illustrated by extracts from student projects carried out for an honours paper in Literary and Linguistic Computing for English.

153 The COMET project (Collection Of Modern English Texts)

Ann Gow (STELLA Project, University of Glasgow)

COMET is a corpus of electronic texts made available for teaching and research via the World Wide Web. There were many issues raised during the creation of the corpus which have implications for future digitization of resources. These ranged from deciding the criteria for selecting the texts to which method should be used to create electronic versions of the texts. Digitization of paper based texts is not a straightforward task. There are problems associated with time and cost for all the digitization processes. The issue of copyright has to be faced before full advantage can be taken of the Internet and its world wide capability.

The project has proved very successful, with COMET being used in teaching and research, not only here in Glasgow but in other European Universities, and suggestions being made to expand it as people realize its potential.

154b A guide to Scottish literature

Jean Anderson (STELLA Project, University of Glasgow)

This paper describes the latest STELLA project, *A Guide to Scottish Literature*. The project will create an electronic resource-base for use in both teaching and research. It is based on 4,000 pages of material created by the Department of Scottish Literature for the distance-taught postgraduate M Phil in Scottish Literature. The material covers literature from 1375 to the present day.

The material has become the basis of an interactive literature course, presented in an easy to use multimedia format. The course will be available on compact disk to universities, colleges, schools and individuals.

The paper addresses the design and production of this course, the intended methods of presentation and delivery and the problems encountered in dealing with such a large volume of text.

Group 16 CASE STUDIES

170 Technology for teamworking in higher education: fixed time or flexible time?

Karen Valley, Christine Steeples and Patrick Hynes, (CSALT, University of Lancaster)

Computer-mediated communications and group working technologies are increasingly being integrated into teaching and learning programmes in higher education. Such tools allow dispersed learners (and tutors) to work together, to share resources, and to exchange ideas over computer networks.

A useful distinction can be made between two types of computer-based communication and groupworking systems. These are synchronous systems for real-time linking and interaction (eg desktop video conferencing and remote broadcasts) and asynchronous systems, supporting communication where all parties do not have to be connected at the same time (eg computer conferencing and groupware tools).

This discussion will explore the educational purposes that these two dimensions of CMC can support. We will do this by contrasting the potential benefits and limitations of synchronous CMC support against those associated with asynchronous CMC. This session will involve a set of 3/4 case studies of innovative HE programmes where a synchronous or asynchronous CMC system has been integrated into the course design. The case studies will present their own viewpoint on why they opted for synchronicity or asynchronicity and describe their own successes and problems.

A number of common themes will be directly addressed in each of the case studies. These themes include issues relating to the scaleability of CMC support; the types of interactivity that can be supported; the degrees of flexibility that can be offered; how collaborative learning for dispersed learners can be enabled; and the appropriateness of CMC systems for certain classes of learners.

We anticipate a lively discussion to follow the presentations, based on the themes that each case study has addressed. The workshop will provide opportunities for delegates to participate in the discussion and the convenors will attempt to tease out generic views on the applicability of CMC tools for teaching and learning support, whether communication takes place in fixed or flexible timeframes.

166 Case studies in synchronous communications systems for teaching and learning

Charles Jennings (Southampton Institute of Higher Education)

The implementation of new synchronous communication systems in teaching and learning is increasing as the telecommunications infrastructure improves and cost models for the use of these technologies are changing.

Until the beginning of the 1990s the costs of using many synchronous technologies (except telephone and radio) fell outside the budgets of most educational providers. Only large corporations and a few innovative smaller organisations were in a position to exploit the potential technologies such as satellite broadcast, audiographics, videotelephony and video conferencing.

The paper will report in detail on the following two case studies:

Case Study 1

The Multimedia Teleschool was a project, partly funded by the European Commission during the period 1992-1995 which delivered professional development courses to some 2000 students across Europe using advanced communications technologies. Within the Multimedia Teleschool synchronous interactive satellite broadcasts were used in conjunction with asynchronous computer conferencing systems. Broadcasts were scheduled every two weeks and students had the facility to carry out group-based interaction through feedback via ISDN-based video conferencing. Issues relating to appropriate pedagogies, technical issues and the cost-effectiveness of this educational delivery system, particularly the synchronous systems, were analysed in some depth.

Case Study 2

In January 1996 the SAFETY-NET project was established as part of the European Commission's TELEMATICS programme. SAFETY-NET involves a number of educational and training organisations and some large companies working in the maritime, port, offshore and rail industries. These organisations are looking to move from traditional training models to new models underpinned by advanced communication technologies. The focus is principally on the development and assessment of competence in safety critical areas. The main technologies to be used include desktop video conferencing, audiographics, smart cards, personal digital assistants with some use of asynchronous technologies such as Internet and CMC.

SAFETY-NET will use a range of synchronous systems, such as point-to-point and multi-point video conferencing and audiographics using ISDN and POTS (plain old telephone system) and support interaction through SAT and VSAT. Considerable work has been done in developing appropriate learning scenarios which effectively integrate synchronous technologies into coherent pedagogical models.

167 The knowledge exchange: supporting IT learning in art education through CMC

Chris Unsworth (University of Derby)

Many Art & Design Higher Education Institutions are currently faced with an increasing skills gap for staff and students as the application of computers within this sector becomes increasingly important. This gap is proving extremely difficult to fill due to the restraints on expansion in HE. Most Art & Design institutions have never possessed established IT teaching staff/ departments which have the competence and capacity to keep pace with this rate of change. This change is directly fed by the continuing and expanding influence of IT in the creative industries to which many institutions direct their graduates (fashion, graphics, television, multimedia etc.). This leads to a position where many established teachers are confronted by a need to satisfy a strong demand for IT instruction from their students but, because of high workloads, have little opportunity for the improvement of their own skills.

The School of Art & Design at the University of Derby is now implementing a strategy which aims to unify all staff and students within one communications environment and by which we can support the exchange of IT knowledge as well as providing diverse other educational, administrative and social functions.

During the past 2 years we have experimented with a number of methods to support online IT learning via documentation on a World Wide Web server. These resources can be accessed from any computer in the School. Whilst this form of access to learning resources provides flexible and convenient delivery for independent study, it does not address the learning support needs of the many novice learners found in the environment outlined. Preliminary evaluation of electronic conferencing to support these learning activities suggests that such a system provides an ideal focus for engendering discussion of IT issues/problems and provides opportunities for online support from both peers and tutors.

We are therefore investigating whether such tools can provide a satisfactory learning experience and also how readily staff and students move towards the adoption of these tools into their patterns of teaching and learning.

This paper will discuss the institutional, financial and curricular reasons underpinning our strategy as well as some detail of the technological choices made.

168 Tutorial support for remote learners using video conferencing

Andrew Marriott (Learning Technologies Centre, University of Central Lancashire)

An increasing number of University courses are now being delivered through a network of Associate and Partner Colleges, where students can enrol on year zero (foundation year) and year one degree and diploma courses, enabling wider access for remote learners. However, supporting large numbers of students (and staff) at these remote sites through traditional methods has become very difficult. Tutorial sessions, course validations, administrative liaison - and many other essential meetings - can take up to four hours travelling time for a return journey.

The University is currently evaluating the use of desktop video conferencing systems (Olivetti PCC) in selected departments at one of its Associate Colleges - Furness College in Cumbria. Systems are available in selected departments across both University and College campuses, enabling teaching staff, administrative staff and students to communicate by means of video, audio, and a range of data-sharing applications. Participating University Departments are:

- Department of Partnership (responsible for administering the Partner College network);

- Department of Education Studies;
- Department of Electronic Engineering;
- Learning Technologies Centre.

The two systems at Furness College are located in open-access areas as drop-in facilities. The paper will present the experiences of the project teams and users, and discuss some of the issues relevant to this type of synchronous communication. Preliminary data from our evaluation process will also be presented in terms of Communication; Teaching & Learning; Technology and Organisational issues.

169 Flexible CMC For ALT Professionals

Karen Valley, Christine Steeples, & Patrick Hynes (CSALT, University of Lancaster)

Computer-mediated communications (CMC) are changing learning and teaching patterns in higher education. Multimedia CMC environments provide opportunities for learning in flexible ways: from distributed locations and within flexible timeframes. They allow learners and tutors to draw upon, and interact with, a vast array of resources: using them to define problems and to represent ideas in different media; and to augment the resources with personal commentary, questions and alternative viewpoints.

In this paper we will explore how CMC operating in primarily asynchronous ways, has been used to promote dynamic learning partnerships: between educational providers and a specialist practitioner community; between tutors and learners; and between learners and learners. We do this by describing a professional development programme that utilises communication technologies for flexible learning networks.

The Advanced Learning Technology (ALT) programme is a modular, part-time distance programme. It supports the acquisition and development of skills needed to design, develop, use and evaluate IT-based learning materials. Learners are involved in all aspects of IT-based learning within higher, further and adult education, and within training contexts. Each module in the programme combines two discrete residential study periods with approximately 12 weeks of independent home/work based study. Between the two residentials, learners maintain contact and share experience and resources with tutors and peers through a computer-based group communications database. The system we use for the ALT programme is Lotus Notes, a system that supports many different forms of shared workspace. Within the ALT programme, Notes is set up such that each module has its own space (conference), with additional conferences for other categories of discussion and information sharing. One of the main features of Lotus Notes is the tremendous flexibility that it offers with regard to the set up of online learning environments. Our change to Notes in 1995, has provided an important opportunity to reassess how CMC is used within our programme, and to evaluate the ways in which asynchronous groupware systems can provide effective learning support for a widely dispersed group, both now and in the future. This paper will explore these issues in detail.

Group 17 CASE STUDIES

90 Curriculum design and software integration: practice and theory

Patrick Allen (University of Stirling)

This paper will describe a case study based on three interventions in three separate departments at the University of Stirling (French, History, and English Studies). Six courses have been modified by the careful and systematic introduction of learning technology.

In each of these projects it has been members of teaching staff that have motivated the development work. Therefore, the roles played by lecturers and their collaboration with development staff are crucial. The projects were developed through action research on the assumption that, on the one hand, the role of teachers is pivotal in terms of any changes in modes of delivery; and on the other, that the needs of learners should be central in the design of any changes to the curriculum.

The progress of all of these small-scale projects were carefully analysed and documented, from basic needs analysis to the integration of software or changes in delivery mechanisms where this has been appropriate. For each intervention, work began with the detailed analysis of relatively simple tasks that correspond directly to essential skills required of students. A variety of solutions was established, which include, the development and prototyping of bespoke software, the procurement of relevant off-the-shelf software packages, and the porting of teaching materials onto the Web.

Curriculum design and software integration fits into a much broader context. As part of our work at Stirling we have developed a model for the integration of learning technology into the University curriculum. This model was first presented at ALT-C 94 and encompasses the following: needs analysis; course design and software integration; implementation; evaluation. We describe how these small-scale development projects fit into this wider picture and how effectively our model can be applied to real life situations. The paper will conclude with a consideration of the relevance and adequacy of using abstract representations for project planning.

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An evaluation of the use of new technology for purposes of language learning: the Internet for students of languages

Jean Conacher and Frédéric Royall (Department of Languages and Cultural Studies, University of Limerick, Ireland)

Linguists involved in language teaching and thus active in the promotion of communicative skills cannot afford to bypass the opportunities presented by developments in technology and so many linguists are understandably keenly interested in using such developments in the language classroom. While it is true that the approaches, interests and goals of language teachers vary considerably from that of specialists within other disciplines all information available on the Internet is of interest to language learners. The challenge which language teachers may face, however, is to adapt discrete methodological and pedagogical strategies to meet learners requirements in using new technologies. In this sense and in order to guarantee maintenance of high academic standards while ensuring language acquisition, language teachers strive to integrate new pedagogical approaches in language classes and to introduce the principles of autonomous and semi-autonomous language learning through the promotion of new technologies in the language classroom.

The paper will consider such developments and will focus on the means by which specific goals of language teaching and learning for groups of students from diverse specialisms may be attained. The paper will focus, in general, on the means by which language acquisition has been ensured by the promotion of new methodologies in language teaching and the introduction of new technologies in the language classroom. It will focus, in particular, on an examination of examples whereby language acquisition has been promoted through access to the World Wide Web and to email. Examples will be drawn from the experiences of language learning by students of French and German from the areas of the Social Sciences, Engineering and Science at the University of Limerick, Ireland.

224

The Greenwich experience: coping with large numbers of students and multi-sites

Suzanne Healey (University of Greenwich)

This paper gives a very brief outline of the development of the Language Centre at the University of Greenwich: Why did it happen? What make us decide to choose a particular technology and layout? How did we cope with difficulties? What did we do right? What would we do differently?

I will consider what people mean by *Language Centre*: is it a drop-in centre, a well equipped language laboratory, a resource centre or an income-generating opportunity for the Language Department? Do we want users to be entirely free to explore available materials or do we guide them? If so, how much guidance should we give? What form should it take? Who should give it? In brief, what do we mean when we talk of *self-access*?

I will explain how we *monitored* the use of the Language Centre through a login system, and how we ensured that quality of teaching and learning was maintained. I will give examples of a timetable for centre supervision, discuss how to increase resources and show the importance of finding adequate technical support. I will explore the myth of a clash between machine and human input in the language learning process.

I will show some examples of evaluation and quality control forms and questionnaires. I will present data obtained from responses to questionnaires and graphs designed using a commercially available computer package.

In conclusion, not only do we take note of Language Centre users' comments for future developments, but we also integrate Language Centre technology into the curriculum by reviewing assessment procedures and staff development activities.

Group 18 INSTITUTIONAL STRATEGIES

44 The Academic Development Fund at the University of Derby: applying the experience and lessons of national competitive bidding

Chris O'Hagan and Jane Fry (University of Derby)

By early 1994 the University of Derby (a very new University) had been successful with a number of bids for technology-based learning projects: in Phase I TLTP as a member of the Earth Sciences consortium, and in Phase II TLTP with the institutional project VESOL/TOTAL. The JISC project EASI completed a successful 18 months.

Those involved in these bids became very aware that invention also needed planning, cooperation, ongoing stimulus and much more. The expansion of such development activities to involve many other staff in the institution looked a better way forward to establishing new skills for new learning methods than most other possibilities.

There was a University development fund already in existence, but it was small, could not buy staff time and was administered in a rather ad hoc manner - leading to a low profile. What was needed was more cross-institutional awareness and impact, with the possibility for cascading skills learned from projects.

Pressure was applied for the creation of a larger fund, with more representative administration and decision making, and with open criteria. An argument against this kind of open bidding, a la TLTP, had been - *"What about the risk of disappointment of failed bidders, leading to despondency?"* To which the reply which finally prevailed was, *"What about all the imaginative and innovative thinking which even failed bidders might put to use?"* Plus it would spread the skills of competitive bidding more widely, hopefully improving external income generation.

An Academic Development Fund with £200,000 was set up in late Summer 1994. Bids were called for from Schools and Support Services. Around 40 bids totalled over £500,000 - 15 were chosen. Those 15 are now almost all complete. The impact has been enormous, helping change the culture of the University very significantly. A call for bids to a fresh ADF, 1996/7, with up to £200,000 has just been released.

This paper will record the rationale and processes developed, plus the ups and the downs of administering the fund; it will discuss the workings of the Academic Development Fund Committee, and the lessons learned.

68 New directions in teaching and learning: Nottingham's teaching and learning strategy

Stephen Hibberd (Department of Theoretical Mechanics, University of Nottingham), Martin Binks (School of Management and Finance, University of Nottingham) and Joyce Graves (Cripps Computing Centre, University of Nottingham)

At Nottingham the integration of IT within a new Teaching and Learning Strategy (TLS) has been adopted to enhance the emerging opportunities confronting universities. Higher Education has changed dramatically and significantly in various well known respects that include steep increases in student numbers, changes in HE funding, Research Assessment, Teaching Quality Assessment (TQA), etc. From an environment of relative stability it has moved to one of continual adjustment and further changes will continue to occur for the foreseeable future as the role of HE is reappraised through the Dearing Commission, the relationship between HE and employers, the economic contribution of graduates and growing access. To accommodate these new forces of uncertainty and unpredictability it is essential for institutions to adopt organisational structures which are alert to new conditions and produce prompt, efficient and apposite response.

To meet the intense competition and scrutiny in both research and teaching, Nottingham has developed an active TLS that builds on its strong research base and draws heavily on the experiences of the TLTP and of Enterprise in Higher Education. An institutional structure to implement this strategy has already been put in place and key staff have been recruited or seconded to the initiative. High priority is given to the rapidly growing sophistication of IT in all its facets within the new opportunities offered for both teaching and learning within the areas:

- teaching, learning and assessment methods and resources;
- the dissemination, development and integration of CAL software into the curricula;
- students responsibility for their own learning and development of transferable skills;
- establishing teaching and learning networks within and outside the University.

Ongoing innovation is encouraged by the availability of three earmarked central funds to provide rapid response (pump priming), strategic and quality assessment support.

In this paper we describe briefly the recursive structure of the TLS and focus attention upon the integration of IT developments within the cycles of research assessment, TQA, Internal Audit and Academic Resource requirements. Finally, we provide examples of innovations which have been supported through this strategy and which illustrate the wide variety of initiatives.

130

Achievements of a TLTP institutional project

Gordon Doughty and members of the TILT Project (Robert Clark Centre for Technological Education, University of Glasgow)

The University of Glasgow's institutional TLTP project *Teaching with Independent Learning Technologies* (TILT) established ways to use, produce, evaluate and adapt learning materials based on Information Technology, and ways to enable students to make much greater use of independent learning technologies, to improve the productivity of the teaching staff, while maintaining and enhancing the quality of the students' learning experience.

This paper reviews what the three-year project achieved, and what institutional strategies have been adopted to ensure that its legacy is being reinvested. Comparisons will be made with methods utilised in other institutional TLTP projects.

We worked as a network of groups of mutually supportive but independent teachers, applying an action research-like methodology. We have shown how the integration of IT into UK HE teaching and learning can be greatly assisted by applying formative evaluation of the processes. Staff were helped to evaluate the costs and benefits of investing in IT for teaching and learning. We demonstrated productivity improvements from students' training in IT skills. Staff improved learning through computer mediated communication for teaching and assessment. We related IT to teachers' perceptions of teaching and learning, and dealt with difficulties in adopting IT. We disseminated results through discussions, reports, workshops, staff training and the Internet.

Some of the TILT contract staff have been retained to continue work on technology in teaching & learning, to operate a TLTSN Centre, to work in Faculties, and on various short-term contracts.

HANDS ON WORKSHOPS SESSION TWO

TUESDAY 17 SEPTEMBER 0900-1045

20 Hand held technology tailored for mathematics: keeping up with the students

Harry Gretton and Neil Challis (School of Science and Mathematics, Sheffield Hallam University)

Hand-held technology tailored for doing mathematics (and for learning mathematics as well) is continually advancing. An example of a recent and significant development is the TI-92 - a hand-held device which combines the symbol manipulation facilities of Derive and the dynamic geometry of Cabri (both formerly only available on a PC) with the powerful features of the IT-82 and TI-85 graphic calculators, all of which link with a PC. Students now have hand-held technology on a par with much more expensive PC based software.

In this workshop participants will have the opportunity to review the range of hand-held devices which are available. They will be able to try their hand at using several of them, including the TI-92. They can discuss which students should have which devices. Also available will be the CBL data logger device, which allows all the range of hand-held devices to gather real world data on for example movement, light, temperature, pH, heartbeat and so on. This real data can then be analysed either with the hand-held machine or on a PC through the link. Participants may also exchange experiences (often rife with controversy) of introducing such devices into their courses.

50 Modelling global warming using MATLAB with SIMULINK

C G Mingham and D M Causon (Department of Mathematics and Physics, Manchester Metropolitan University)

A case study is described which has been developed by the authors for a unit on *Physical and Environmental Models*, currently taught in the second year of an undergraduate course in Applicable Mathematics. Environmental issues provide a rich source of exciting and enlivening material for courses in mathematical modelling. This is particularly true when the lecture material is complemented by the use of powerful modern computer software which enables students to construct models, experiment with different inputs and obtain solutions quickly and easily without becoming side-tracked by the solution methods.

A two-box climate model has been proposed by Gilliland. This results in a pair of simultaneous ordinary differential equations for the upper and lower box temperatures. The upper box consists of mixed atmosphere, upper ocean and land, whilst the lower box represents the deep ocean. The upper box equation is obtained from an energy balance of incoming solar radiation, moderated by the planet's albedo, and outgoing components due to infra red transmission and energy exchange with the lower box. The lower box equation accounts for energy exchange with the upper box and represents the ocean circulation currents. Terms in the equations can be varied to account for varying levels of greenhouse gas emissions enabling simulations to be carried out of the earth's temperature variation with time.

The equations are solved numerically using MATLAB with SIMULINK. SIMULINK is a icon based, mouse driven simulation tool consisting of components like multipliers, adders and integrators which can be connected together to give a schematic representation of the differential equations to be solved. We have discovered that students find this graphical medium exciting to work with and can quickly vary input parameters and integration routines to simulate different greenhouse gas emission rates. For the complete beginner, SIMULINK is easily mastered in a very short time.

Our workshop session will proceed in three parts: a brief introduction to the climate model, followed by a hands-on introduction to SIMULINK and finally implementation of the climate model and a study of the effect of increasing CO2 on global temperatures.

172 Supporting flexible learning patterns through the use of computer mediated communications

Christine Steeples and Mark Bryson (Department of Educational Research, Lancaster University)

The aim of this workshop is to share experience of best practice in the use of Computer Mediated Communications (CMC), so that participants are better able to support flexible patterns of teaching and learning. Such flexibility is crucial if we are to maintain quality in teaching and learning in HE, whilst providing a cost-effective response to the needs of an increasingly diverse and growing student population.

CMC tools include email and computer conferencing to allow learner and tutors to engage in learning activities in flexible ways, particularly in terms of timing and location. The workshop will focus on new tools available but examining their use in terms of educational issues rather than from a technological perspective.

The workshop will also examine a number of *success models* drawn from our experience of CMC at Lancaster University and our work on the BT-funded project CMC in HE. The *CMC in HE* project has explored the potential of using CMC with other institutions across the UK HE sector. Details of the project, its activities and findings will be reviewed in the workshop.

The workshop will also include a practical *hands on* session using a computer-based communication system. Participants will be able to explore Lotus Notes software: a highly developed tool for group-based communication and collaborative working/learning. The workshop will then conclude with a plenary session where participants will have the opportunity to:

- explore the issues of access and flexible provision;
- consider their own goals in offering more flexible patterns of learning support;
- examine the kinds of flexibility they are seeking to provide;
- identify how CMC might contribute to more flexible learning support;
- consider how they might customise one or more of the models presented to their own purposes.

246 Java - can control be returned to the teacher?

Ruth Thomas (ICBL, Heriot-Watt University), Douglas Robertson (Engineering Department, University of Cambridge) and Iain King (ICBL, Heriot-Watt University)

The World Wide Web in its original form as a web of interlinked pictures, movies, graphics and text provided an exciting method for delivery of open learning material, one which was simple enough to be accessible to teachers without the help of computer professionals. Gradually, over the last two years the sophistication of the Web has grown and the range and complexity of tools necessary to make full use of the Web again require the use of computer-professionals. Of the recent developments in Web technology it is Java, a cross platform language designed by Sun, which allows inclusion of application programs within Web pages which is perhaps the most useful to educators but the most difficult to use.

With most Web-based courseware, the user participates passively as a browser of pre-provided information. Users are free to ask *what is?* and *how?* but not *what if*? and *why?* They cannot form and test hypotheses as they could do with a more interactive and dynamic system which included application programs such as simulations. Java makes this possible. However, production of courseware which uses simulations is not simply a matter of starting up an application program, the material must be set in context, the students must be focused and guided in their exploration. The downside of this is that to accomplish this, the teacher again requires technical expertise.

To combat this, a prototype Web-based system, *Author!Author!*, has been developed by members of the INTERACT (TLTP) project that allows the non-programmer to easily tailor the appearance and form of Java and certain other applications programs within Web documents and hence to produce interactive courseware units without recourse to a technical expert. A courseware unit produced within Author!Author! can be easily amended and thus templates of example courseware units can be provided for novice authors. Collections of courseware units related to a particular application program can also be stored on the Web as a resources-base for teachers.

This hands on workshop would provide delegates with the opportunity to use Author!Author! to explore the educational potential of simulations on the Web and to produce their own interactive Web-based teaching material incorporating Java Applets.

TUESDAY 17 SEPTEMBER 1200-1300

Group 1 EVALUATION

87

From cadaver to computer: incorporating computers into the topographical anatomy laboratory

Kim Issroff (Higher Education Research and Development Unit, University College London), Paul O'Higgins and Mark Osmond (Department of Anatomy and Developmental Biology, University College London)

Traditionally students have studied human anatomy through dissection and prosection. This requires considerable input from tutors with students working in groups much of the time. This can inhibit their independent learning. Increasing student numbers, decreasing funds for staff and a need to encourage students to develop independent learning skills that will be of value throughout their professional lives has meant that the nature of their learning in the topographical anatomy laboratory has had to change from a situation in which groups of students are guided by demonstrators to a self-directed learning environment. Therefore several innovations have been introduced, including a multimedia laboratory which is the emphasis of this paper.

The aim of the multimedia laboratory is to encourage self-directed learning, provide students with a means of independent study and to allow students to progress according to their own individual requirements whilst achieving the overall objectives of the curriculum. The computers have now been in the topographical anatomy laboratory for two terms with a variety of CD-ROMs and software. There is an ongoing evaluation of their use and effectiveness involving questionnaires and interviews and incorporating the views of students as well as academic and technical staff.

The paper will focus on the results of the evaluation and the lessons learnt from the early stages of setting up a self-directed learning environment. Setting up this type of learning environment involves a considerable amount of resources, both in terms of staffing and hardware and software. While many of the students use the computers, the majority do not know how to use the software effectively and although students do take responsibility for their own learning, they value the contact with and input from academic staff.

254

Urology computer assisted learning programmes for medical students

Andrew Elves and Min Ahmed (Bristol Urological Institute)

The use of interactive educational computer programmes is becoming increasingly common in many areas of education. We report the use of a computer aided learning (CAL) programme in the teaching of urology to medical students.

Four CAL tutorials were developed covering examination of the urological patient, prostate cancer, impotence and lower urinary tract symptoms for initial evaluation. Twenty-six third-year medical students seconded to the department for one week of urology teaching were randomised to two equal groups. One group used the CAL programmes in addition to daily teaching while the other group only received the daily teaching. Teaching was of a standardised format, covering all aspects of urology including the four areas covered by the CAL tutorials. Students were assessed by use of a standardised MCQ questionnaire at the start and end of the weeks teaching. Responses were negatively marked. Content and ease of use were also evaluated by questionnaire.

There was no difference between the two groups with regard to MCQ scores at the start of the week. The mean change in score over the week for those using the CAL tutorials was 6.0 (SD = 7.0), and 0.9(SD = 6.0) for the control group. This was highly significant ($t(24) = 3.166$, $p<0.005$). Students reported the tutorials to be easy to use, and of satisfactory content.

The result of our study would suggest that CAL programmes are beneficial to students' learning.

Group 2 EVALUATION

15 The influence of learning strategy in a computer mediated learning environment

Pat Paterson (Department of Information Science, University of Portsmouth)

Much well respected work has been done in the past on the study of learning styles and learning strategies, and how mismatches between learning preference and learning environment may inhibit students' success. In the work reported here investigations into students' learning strategies are used as tools with which to explore learning success within the context of a computer mediated learning environment. Computer based education is generally viewed in a very narrow way as, for example, by making use of certain specially written learning packages in specific learning situations. In this paper, the term *Computer Mediated Learning* (CML) is used to encompass all aspects of learning which involve the use of computers, from the medium of an instructional package to the use of the computer as a sophisticated tool for exploration, recording or calculation.

Recent investigations on groups of students on three different courses have shown that the above observations are as relevant in a computer mediated learning environment as in a traditional one. In particular, it has been shown that in a computer mediated learning environment, a versatile learning strategy is more likely to lead to learning success than either a strongly serialist or a strongly holist learning strategy. This supports Ford's suggestion that students taught in a style that does not suit them will be more successful if they have the ability to restructure the information. Furthermore, it has been shown that higher percentages of CML enhance the correlations between success and learning strategy.

Therefore it becomes even more important to develop global learning strategies in serialist learners and serialist learning strategies in global learners. Holist skills are necessary for the grasp of a global understanding of a CML experience, the nature of the software employed and how its use fits in with other elements of the unit or module under study. Serialist skills are needed to select and apply the relevant discrete concepts. Purely operation learners - serialists - have problems transferring understanding to other areas of the domain whereas purely global learners - holists - see so many possibilities that they have problems applying concepts in a practical way.

40 An assessment of the comparative effectiveness of three methods of multimedia learning

P Hogg (University of Salford), T Boyle (Manchester Metropolitan University) and R Lawson (Manchester Royal Infirmary)

The aim of the study is compare the effectiveness of a multimedia CAL system based on the CORE approach to two control groups based on a standard electronic book and a multimedia lecture. Two multimedia CAL prototypes were developed for a section of an undergraduate curriculum. One prototype was based on an electronic book metaphor with support for hypermedia linking; the second was based on the CORE approach of guided discovery learning. Each CAL system used the same screen layout and navigation aids. The multimedia lecture's content was closely matched to the CAL prototypes.

The three multimedia treatments were assessed using three groups of year 2 radiography students. Each group studied a specified area of nuclear medicine using one of three methods. These treatments were embedded as part of the normal undergraduate course. Detailed information was gathered from each group on learning effectiveness and the students' assessment of the learning method. A range of quantitative and qualitative measure were taken. Estimates of deep learning were obtained from an essay on a topic and a five day case study based on the material covered. Pre- and post- session knowledge gain was established through a multiple choice questionnaire. The students were also provided with a taster of an alternative method in order that they could provide comparative comments on the learning methods.

All three groups showed an improvement between pre and post session knowledge. Both CAL conditions elicited favourable reactions. The CORE group had the highest post-treatment knowledge. The students generally stated a preference for the CORE approach as opposed to the standard electronic book approach. The reasons for preferring the CORE approach included the integrated subject approach (as opposed to more open hypertext format in the electronic book) and the use of guided discovery as a means of learning. The price paid for these advantages was in the increase of time taken for deep learning.

Group 3 EVALUATION

103 Do students learn when they use simulations?

J D Milne (CLUES, University of Aberdeen)

Laurillard suggests a conversational framework for student learning. The contribution of simulations to the learning process is fitted into this framework. Laurillard argues that simulations are descriptive. They describe the situation to students who can then change the inputs and observe the effect of these changes on the output. The simulation does not judge the students' actions, it only responds to their input. The students can think about explanations for the observed changes in the output but the simulation will not indicate whether the explanation is adequate.

Using Laurillard's framework as a benchmark, this paper reports on a number of case studies investigating student interactions with simulations. It outlines the results from classroom observations, student interviews, tests and student questionnaires. In particular the investigation addressed the following:

- Did the student interactions follow Laurillard's conversational framework for a simulation?
- Do the students ideas develop as they use a simulation?
- Are their ideas challenged as they use the simulation?
- How close did the students get to achieving the learning outcomes set by the lecturer?

This evaluation has identified two approaches adopted by staff when embedding simulation models in courses. The first approach challenges the student to set up a hypothesis and then use the simulation to generate data that tests the hypothesis. The second approach uses the simulation to produce data for a prescribed situation or scenario. This latter approach does not encourage the student to think about concepts when they are using the simulation. Both approaches will be discussed and compared to the hypothetical use of simulations described by Laurillard. It is recommended that lecturers allow students to adopt an experimental approach in the use of simulations in which the student sets and tests hypotheses.

144 Evaluating the impact of technology on education: a radical reappraisal of educational technology research

P David Mitchell (Concordia University, Montreal, Canada)

Much published research about educational technology draws unwarranted conclusions based on sloppy thinking, inadequate design, so-called measuring instruments that do not measure, illogical use of null hypothesis significance tests and/or use of inappropriate statistical tests. The paradigm informing most educational research is an input-process-output model which assumes a one-way direction of causality from independent to dependent variables. This model (expressed as y=bx+a) lies at the heart of t-tests, correlations, analysis of variance, multiple regression, discriminant function analysis, etc. But what if this model is wrong? Fundamental flaws include:

- misapplication of deductive reasoning (wrongly assuming that the probability of obtaining *these data* in an experiment, *if* the null hypothesis were true, is equal to the probability that the null hypothesis is true, given these data) when the literature of statistics for over half a century has considered null hypothesis statistical testing to be erroneous;
- passing subjective judgements off as measurements (by attaching numbers to constructs for which none of the properties of measurable magnitude are met) and then combining these, violating stringent mathematical requirements;
- treating words (eg computer aided learning, learning style, multimedia) as if they are precise;
- ignoring students' intentions.

Is there any hope? Researchers in cybernetics, investigating purposeful behaviour, showed that, *"the one-way cause-effect model that underlies virtually all group-statistics-*

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based educational and psychological research is inadequate to account for even the simplest of purposeful behaviours". If much of our students' behaviour is purposeful, where does that leave us? We conclude that the model-based approach of cybernetics and operational research is essential for educational research.

Group 4 COURSE STRUCTURE

48 Plans for an international electronically-supported Master's degree

David Hawkridge (Institute of Educational Technology, The Open University)

The Open University has 25 years' successful experience of teaching large numbers of students at a distance by a combination of print and other media, including radio and television. In the OU system, tutoring is based mainly on correspondence methods, although students can also meet their tutors in study centres and for some courses attend short residential *schools*.

The OU is increasingly using new technology for teaching and learning (20,000 students are using modems this year) and recently began to offer selected courses internationally via the Internet. For example, in 1995 two courses and a Virtual Summer School were almost entirely conducted this way.

In February 1997, the OU's Institute of Educational Technology is launching an international MA in Open and Distance Education, aimed at teachers and administrators in institutions already using or intending to use open and distance education. The degree can be taken part-time, in any country except, by agreement, Australia. Course material will be delivered via courier or postal service as print, audio, video and CD-ROM.

Apart from being at the OU, which is an international leader in open and distance education, the degree is based on the Institute's top-rated research. It is also unique at the OU in that the students will:

- keep an electronic workbook;
- make extensive use of the World Wide Web for obtaining up-to-date learning resources;
- receive tutoring from Institute staff via the Internet;
- submit many of their assignments via the Internet.

The paper, together with handouts, will provide further details concerning these four unique features, and will invite discussion regarding quality assurance of each feature.

70 MSc multimedia applications: a case study in developing a new Master's scheme at Teesside

Stephen J Green and Elaine J Pearson (Visualisation and Interactive Systems Research Centre, University of Teesside)

In a recent validation of a new MSc course in Multimedia Applications at Teesside the panel *"congratulated the proposers on such an innovative proposal"*. However, they went on to require as a condition *"a separate document to indicate how the innovative teaching and learning proposals will be delivered and managed"*. A new course which combines both novel content and modern approaches to teaching and learning will inevitably invite a level of mistrust and some lack of understanding. Typically a validation panel will rely on the faith they can place in individual members of the course team to deliver. But in current climate in higher education how much faith can course team members have in themselves? Can institutions and individuals really afford to go down the learning technology route?

This paper attempts to address many of the issues which relate to the problems of integrating new teaching and learning approaches and new course provision. We cover aspects such as course proposals and scheme progress boards, the pitfalls of validation and professional accreditation, course development, course delivery and resourcing, staff development and learner management. In particular we concentrate on the integration of the variety of teaching and learning strategies available to scheme developers including (among others):

- integrated workshops;
- case studies;
- individual and group projects;

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- CSCW;
- intranet and internet;
- multimedia courseware;
- course files and learning journals;
- learning contracts.

Many of our comments are based on experiences of delivering modules to MSc Information Technology students (courseware design and information systems) and on developing the MSc Multimedia Applications programme itself. We conclude that staff development, learning technology and resourcing issues are paramount and that new courses are initially very costly. However we also ask whether higher education institutions can continue to ignore the impact of technology and new learning approaches on educational provision as we enter the next millennium.

Group 5 CASE STUDIES

67

A recipe for the successful integration of computer technology into teaching and assessment (dait and chips)

Michael McCabe and Ian Troise (School of Mathematical Studies, University of Portsmouth)

Ingredients

43 first year students, 1 new degree course, 4 TLTP projects, 2 assessment packages, Maple software and 40 PCs.

Method

1 The fresher the better

The squeezing of technology into existing courses can be difficult. A new BSc degree in Decision Analysis and IT (DAIT) in the School of Mathematical Studies at the University of Portsmouth avoided this problem. The first cohort, freshers with mixed mathematical abilities and from wide-ranging backgrounds, registered in October 1995. From day one, the teaching of foundation mathematics used a high concentration of computer based materials, most of which had only just become available. This paper evaluates the impact of the new teaching and assessment methods.

2 *Diagnostic testing*

The TLTP software package DIAGNOSYS was used immediately to help students assess their own strengths and weaknesses, to help them feel at ease with the use of computers in mathematics and to provide early feedback.

3 *Adaptation of learning materials*

During weekly practical classes students followed lab investigations designed to complement the unit text and encourage use of Maple computer algebra. Some worksheets were adapted from the TLTP-funded Transitional Maths Project.

4 *Use of TLTP software*

Although a restricted number of modules were available, study of MATHWISE and TRANSMATH CBL mathematics software was recommended. Strategies for encouraging computer-based learning were developed, including the provision of cross-references with the main text and recommendations for self-assessment;

5 *Integrated assessment*

Question Mark Designer tests, incorporating *multimedia calls* to Maple computer algebra and integrated external tests (see software demonstrations), were developed for assessment.

6 *Evaluation*

Both paper and computer-delivered questionnaires were used in the evaluation. Students reported favourably on computer-based study and tests which required software to obtain answers directly on screen, but were less enthusiastic about *mixed-mode* work where pencil-and-paper was required simultaneously. More explicit instructions for concurrent work on screen and paper seem necessary.

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Computer therapy for algebra-phobics

Karen Shipp, Tony Nixon and Canan Tosunoglu (The Open University)

For many years we have provided students studying the Open University technology foundation course with CAL materials to develop their numeracy skills to the required level.

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Despite the popularity of these highly interactive packages, there has always been a small group of students for whom certain key topics remain a problem.

These students appear to have a mental block about algebra, and have been unable to absorb or retain the (to us) clear explanations in the numeracy texts and CAL packages we provide. Many have had bad experiences at school which make them give up, feeling panic or confusion, as soon as they see anything with x or y in it.

This year we are addressing this problem with a new type of package, based on a game developed in face to face work over 18 months with a number of groups of students. The package we describe targets the specific problems experienced by our students. While developing the package we realised that the learning material we were producing could be regarded as a form of therapy for algebra-phobics. Several strategies are used in the package:

- we start with something that has no associations with algebra (tiddlywinks);
- we hard-wire the algebraic manipulations into the user's brain, by the repeated performance of physical movements;
- we use manipulation rules which can (later) be explained very simply;
- we move by imperceptibly small steps from tiddlywinks to algebra;
- the user is supported by unobtrusive but extensive hints and help;
- we give the mathematical explanation right at the end, once the user has gained confidence and familiarity with the rules;
- we present this in a visually pleasing game, so the user feels inclined to go back to it for reinforcement in odd moments between other work.

We will explain and demonstrate the principles which underlie our approach, and how the game was adapted from a face to face activity to a stand-alone CAL package. We will discuss the reaction of students to the package during development and evaluation. The package has now been delivered to three and a half thousand students, for use at home. We are using computer conferencing with these students to further evaluate the package.

Group 6 CASE STUDIES

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Facilitating a *good* learning experience: the acquisition of computing skills for students of business subjects

Anna Hobbs and Jim Snaith (University Business School, South Bank University)

This paper explores the challenges of preparing, administering and delivering a range of courses in Business Information Studies to non-specialist computing students. These courses consist of a substantial, practical hands-on component and often operate in an environment characterised by a large student throughput and the inevitable variety of staff required to support cohorts of between 200 and 250. The added dimension of modularisation and unitisation, where students following different routes to their final degree share the same unit or module, enhances the challenge.

The research upon which this paper is based explores the nature of the learning experience for non-specialist computing students within the computer laboratory environment. This primary research consists of a study carried out over a four year period with students following undergraduate programmes in Business and Finance, and Accounting and Finance at South Bank University Business School.

Analysis of the initial data, which was obtained via questionnaires completed by students reveals a less than positive learning experience for these students. In essence, students with less experience in the use of computers and those with considerably more experience described their laboratory time as *poor*, but for different reasons. Negative learning experiences were reported by 68.5% of the sample.

In response to this information, and in an attempt to change the general learning experience within computer laboratories, a series of resource-based learning materials was developed. Analysis of data taken after the move towards a resource-based learning approach reveals a more positive and fundamentally different learning process for the students.

This paper is intended to be of use to academics endeavouring to develop competence, confidence and skill, and also to teach principles and concepts to students. It is intended to be of particular interest to those involved with the teaching of computing to large numbers of non-specialist students.

255 Coping with diversity: the challenge of producing computer-based tutorials for historians

Jan Broadway (TLTP History Courseware Consortium, University of Glasgow)

Although degree courses in history and related disciplines are all trying to teach their students the same skills, there are no two courses that use the same information for the purpose. This diversity presents particular challenges for those attempting to provide computer-based tutorials for the teaching of history in higher education:

- there are no universal subject areas taught at all institutions;
- no two courses on the same subject area are the same;
- there is no subject-based knowledge that everyone taking a course on a particular subject can be presumed to possess;
- there is little tradition of exchanging teaching materials.

These challenges impose a number of requirements on those attempting to produce computer-based tutorials:

- the tutorials must address areas of general interest;
- depth must not be sacrificed in the interests of breadth;
- the tutorials must be flexible to allow their incorporation into a number of different courses;
- they must allow the local lecturer some ability to adapt the material provided for local use.

The challenges imposed by the way in which history is taught in British Higher Education were recognised in the early stages of the life of the TLTP History Courseware Consortium's life. A few major historical themes were chosen within which separate tutorials focus on important highlights. A large number of institutions are involved in the preparation and evaluation of tutorials. The ability to customise the tutorials locally was an important consideration in their original design.

Now our tutorials are beginning to be used in undergraduate teaching by lecturers other than the original authors. Local lecturers are beginning to adapt the materials to their own courses. This has raised new issues and challenged some of our assumptions about how the tutorials would be used. This experience is now being utilised to ensure that the tutorials still under development more closely meet the needs of history lecturers.

Group 7 INSTITUTIONAL STRATEGY

243 Cross-curricular IT tools for university students: developing an effective model of provision

Peter Kemp (Academic Services, University of Glasgow) and Allan Martin, (Office of Information Technology, University of Glasgow)

There is an increasing demand in higher education institutions, from both students and faculty, for the provision, across the whole range of subject departments, of basic information technology (IT) awarenesses and skills. There are a number of reasons for this, the principals of which are the awareness of both staff and students that IT skills can enhance learning potential, and the perception that IT familiarity and confidence, especially with generic applications, can enhance a student's attractiveness to employers at the end of the course.

At the University of Glasgow the response to this demand has been made centrally, through development of a coordinated IT strategy across the University, and provision of a programme of courses intended to promote familiarity and confidence with IT. A coherent strategy for developing IT use across the whole university is a necessary context for avoiding piecemeal development of courses in particular departments; this has involved the provision of funding and support for IT facilities located within departmental bases, the sponsoring of a campus-wide network and student computing environment, and the funding of a modular course providing generic IT familiarity.

Establishment of the course followed extensive consultation with staff, students and employers which showed strong support for an IT skills training programme. Employers emphasised the importance of skills in the use of IT, especially in enhancing communication, rather than simply competence-based expertise; the course emphasises this aspect. The results of this consultation were sufficient to persuade the University management to resource the course adequately for a period of three years.

The course programme has now been in operation for two years, with circa 2,500 students passing through in 1995-96. At the heart of the programme is a basic IT course which offers an introduction to those applications considered fundamental to study activities, with an emphasis on integration and transfer of data between applications, and development of a sound understanding and a lasting familiarity with file handling and housekeeping operations. A range of further modules permits students to develop expertise in the direction and to the level they wish, with the focus on either applications or tasks. The courses are offered either on a voluntary basis outwith students' normal timetables, or integrated within curricular structures at departmental and faculty level.

This IT strategy and the centrally-provided IT course are currently at an early stage of development, and evolution of both will be inevitable and desirable. Changes have already occurred, and others are under discussion. What is certainly clear already is that action at the institutional level can be effective in addressing the issue of IT empowerment, and is largely welcomed by both students and staff.

258 Working with the WWW in academia: a critique

John Scully (Liverpool John Moores University)

Economic argument and educational claims drive the application of computer technology to the very fabric of institutional academic life. With the advent of the World Wide Web the arguments for application seem to be more pressing than ever and academics around the country are being guided to incorporate the available technology into their everyday lives. The applications are logically coherent and compelling and yet do not seem to gel well with academic work on the ground. In fact academic staff are not incorporating the technology into their daily lives to any significance. This paper, through the presentation of a brief questionnaire study of staff in Liverpool John Moores University, examines why the technology, and especially the World Wide Web, is not taking hold on the ground and argues that the main reason for this is the a-theoretical approach to IT development adopted by many institutions of Higher Education. The cultural change that is envisaged through the application of these technologies will not occur unless there is enlightened application of the technology to the academic work-place. This effectively means a shift in emphasis from technology-led development work to work-place led technological application. This entails a new strategy which incorporates a new methodology and language and which accepts that lasting cultural change does not happen overnight but rather over period of time.

Group 8 STAFF DEVELOPMENT

184 The impact of computer mediated communication (CMC) on distance tutoring

Lynn Woodward (School of Health, University of Greenwich) and Malcolm Ryan, (Academic Development Group, University of Greenwich)

This paper explores how computer mediated communication (CMC) impacts on distance tutoring. It describes the experiences of a group of tutors undertaking a staff development activity - On Line Tutors Module (OLTM) - using Lotus Notes. It focuses its discussion on the wider issues and concepts that we believe significantly alter the nature and role of distance tutoring.

OLTM was a curriculum rather than technology led initiative based upon a perceived need by *ordinary* tutors expected to employ CMC to deliver a new MSc programme. The students in this module were colleagues from departments of Health, Education, Learning Resources and Academic Development, because the innovative nature of this MSc demands a broad range of skills and expertise.

The module aimed to facilitate experiential, online learning and tutoring, and the development of CMC skills and concepts. It included face to face sessions and structured activities which emulated how we anticipated the tutors would facilitate the MSc programme. The topics chosen, were relevant to the role of tutoring as well as the nature and function of CMC. The activities moved the students progressively from the known (tutoring) to the unknown (the application of CMC).

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It has been evaluated using the Lotus Notes system to monitor inputs to various conference topics, and student reflection on the skills and concepts acquired and their feelings and views as participants.

Initial findings suggest that employing CMC actually changes the nature of distance education and that those who tutor using this medium need to operate differently from either face to face or traditional distance tutors. As well as the development of new skills, aspects of managing and *teaching* a group of students remotely have been identified. The issues raised may impact not only on the tutors who employ this technology but on their students and the institution.

Our experience confirms that to become effective practitioners staff need to have the opportunity to acquire, develop and reflect on these skills in order to recognise and appreciate the impact of CMC on the role of the tutor.

244 The loneliness of the long distance learner: a participant's perspective

Fraser Lovie (Department of Politics and International Relations, University of Aberdeen)

This paper has as its theme the experiences of a participant in an interactive, computer-mediated-conferencing (CMC) workshop. The workshop was designed to allow distance educators and educationalists from around the world to discuss in an open forum, the relevant issues that this type of learning environment raise: including the use of technology, structuring computer conferencing and general educational issues surrounding distance education, as well as providing hands on experience in a CMC environment (NetFace). The conference itself was moderated from Monash University, Gippsland, Australia and the majority of participants were from Australia or the United States. However, several were from Europe and elsewhere. This is the experience of one of those long-distance learners.

A brief outline of the NetFace environment will follow, alongside some discussion of the actual system itself, pointing to the intuitively obvious hierarchy and the ease with which participants could become involved in discussion without the need for detailed technical knowledge of the system or computers.

The paper will then turn to the main area of interest, the actual experiences of the author as a participant in the conference. This will include reference to the specific problems experienced by someone who - due to the constraints of geography (several time zones from the bulk of the participants), technology (perennial problems of bandwidth) and sundry other commitments - could perhaps become marginalised from other users. Thus the motivational requirements and dedication of such participants will be considered alongside the author's thoughts on why the rigours of such an environment can lead to high drop out rates, creeping deadlines and unfulfilled expectations for some, but not all, of those who participate in such a forum.

Finally, the paper will move on to consider the development of the online discussion and to evaluate the nature of the interaction between the participants. Some of the main themes of the workshop will be highlighted, with the authors assessment of how useful the learning environment was.

Group 9 TEACHING AND LEARNING

110 Development of a media selection support system

Carla Verwijs (Faculty of Educational Science and Technology, University of Twente, The Netherlands)

Up till now, many media selection-models have been developed (for example: Anderson, 1976; Reiser & Gagné, 1983). However, for various reasons, these models are not used in practice by instructional designers or instructors. Most instructors choose the media they will use in instruction intuitively, based on experience and personal preferences.

The media selection models can be seen as a black box which transfers the input (instructional goals, student characteristics, etc) into the output (the media). The black box combines information about media with instruction theoretical principles.

In our project, conducted at the University of Twente, the Netherlands, the black box has been made transparent by providing the decision maker with all information they need to make a media selection. This is information about media (characteristics), instruction theoretical principles, cost effectiveness of media, the integration of media into a media mix, etc. The information is structured in a computer-based *media selection support system* that has the form of an EPSS. Tools are added:

- to help the user analyse the (instructional/ restricting) factors that influence the media choice;
- to handle the information in the system;
- to apply the eventual media choice in the course plan the instructor has to complete for each course.

This media selection support system has been developed in several rounds of prototype development and evaluation. After each round the prototype is revised, depending on the evaluation results. The first interactive prototype of the support system was a so-called *shallow* prototype that contained no concrete information, but only references to the information. This framework of the eventual system has been evaluated by five instructors.

At this moment, the prototype is being revised and filled in with concrete information and examples. During the paper presentation (parts of) the prototype will be shown.

158 A systems-based framework for integrating technology in teaching and learning

Gordon Joughin, David Gardiner (Faculty of Law, Queensland University of Technology, Australia)

Biggs (1993) has noted that education is a set of interacting ecosystems. The components of those systems include students, teachers, teaching contexts, student learning processes, learning outcomes, institutions, staff developers, administrators, politicians; in fact any identifiable component that affects learning. The Faculty of Law at the Queensland University of Technology has elaborated on the work of Biggs and related work by Ramsden (1992) to develop a comprehensive framework for planning, developing and implementing technology-based teaching and learning.

The introduction of technology-based teaching and learning has implications for each element in the teaching and learning system. The framework allows teachers, researchers, administrators and others to systematically identify the implications of technology-based learning for each of the elements of the teaching-learning system.

This paper will elaborate on each of the elements of the framework in the context of a current project to develop pedagogical templates for technology-based teaching in law.

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TUESDAY 17 SEPTEMBER . 1400-1500

Group 10 EVALUATION

17

An evaluation of learning diaries and technology as they impact on student learning

Harry Gretton and Neil Challis (School of Science and Mathematics, Sheffield Hallam University)

At Sheffield Hallam University, technology has been used to varying degrees in mathematics units across the curriculum for many years. In the last two years, the use of technology has intensified, and as one part of an effort to evaluate the effect of this initiative, learning diaries have been used to help students and staff assess, among other things, the impact of technology on an individual's learning.

In this paper we discuss our experience with learning diaries both as a tool to encourage student reflection, and as a feedback mechanism. We will make reference not only to our own experience, but also to that gained from the Open University course MU120 where a similar process is being undertaken. Both developments are not simply treating mathematical skills, but also addressing core skills such as communication, independence of learning, students' identification of their own personal development and learning, and critical thinking.

The use of a learning diary in conjunction with technology has given rise to a range of responses. Some part-time (mature) students have found the process particularly valuable and have extended it into their normal working environment. Other students think it's a waste of time, and some say why can't we just *"get on and teach some proper maths"*. Thus among other things the responses are revealing about students' differing attitudes to and expectations of learning.

This paper gives an account of one aspect of dealing with change and learning from it, from two academics working at the sharp end of HE in an area where rapid developments in technology, curriculum and assessment are being put into practice.

55

Multimedia Motion - motivating learners

Elizabeth Whitelegg (The Centre for Science Education, The Open University), Eileen Scanlon and S Hatzipanagos (The Institute of Educational Technology, The Open University)

This paper reports on the use of the Multimedia Motion CD-ROM as part of the teaching for the Supported Learning in Physics Project (SLIPP) course material *Physics on the Move*. SLIPP is an Open University-led curriculum development project to develop open and flexible learning materials in physics for use by post-16 students in schools and colleges. SLIPP aims to develop motivation for learning physics at GCE A-level and GNVQ Advanced level by using real-life contexts to introduce physics content and by giving students more control over their own learning. In the *Physics on the Move* course material the Multimedia Motion CD-ROM enables students to chart and analyse a range of movements - displacement, velocities, accelerations, momentum, impulse, kinetic energy of a variety of people and vehicles.

During the pilot phase of the SLIP Project, we conducted an evaluation of the Multimedia Motion CD-ROM-based activities. Yilditz and Atkins (1993) suggest a wide range of aspects of multimedia to be addressed in any evaluation. Our eclectic approach was that advocated by Jones et al (1995). The evaluation consisted of observations of teacher and student use of the material in two schools augmented with data obtained from 21 questionnaires administered in a further two schools. The observations involved 12 students in around 60 hours of computer-based activity and the resulting data are in the form of videotape records, observation schedules and student self-reports.

Analysis of the data raises a number of issues about how exploratory learning can best be supported by multimedia. We observed the expected benefits of increased motivation for learners because of access to more realistic applications of the laws of physics illustrated in the disc as predicted by Hatzipanagos (1995). However, several other factors appeared to be important to students when using the disc. These included:

- school mode of use;
- difficulties with graphing;
- students' perceptions of the relationship between practical work and computer-based activities;
- support for exploratory learning styles.

There are certain learning styles which it is claimed multimedia can support, among them exploratory learning. In this paper we will explore how teachers' and students' perceptions of the task involved in learning post-16 physics must be addressed in designing suitable multimedia tasks.

Group 11 EVALUATION

46 Supporting the learning of mathematics using computers

Hakim Moi (Praxis plc, Bath) and Ray McAleese (Combined Studies, Heriot-Watt University)

This session will concentrate on describing an experimental study of the way students studying mathematics used a supportive learning environment (ISM). The research was a doctoral dissertation. Traditional approaches to mathematics teaching and learning involve lectures and pen & paper based tutorials at home or in a classroom setting. Technological innovations in the form of CBL have brought about many changes in the ways in which instruction and learning might be delivered and organised. Technology does not just add to or replace something in the existing environment for learning, but also opens up a variety of learning strategies. It was these strategies that this research set out to detect.

Drawing, in particular, on the experience of CALM at Heriot-Watt University, ways and tools by which computers can be used to supplement existing traditional methods for teaching and learning of mathematics in the university sector were further investigated.

The work focused on the structuring and presentation of mathematics subject matter using a combination of computer graphics to visualise mathematical concepts, animation, and testing of student comprehension of the subject materials.

This covers, in particular, problem solving, visualisation in mathematics instruction, constructivistic learning, planning, retrieval of tasks, and the need for external computational aids to memory.

The ISM model of support for learning of mathematics consists of four components: structured didactic courseware materials; a help and browsing system; a notebook metaphor; and specialist tools. This session will:

- describe and evaluate the ISM system;
- locate it in the existing CALM philosophy;
- identify the characteristics of ISM that lead to significant change in the approach to learning;
- draw conclusions that suggest that the ISM support for learning mathematics does enhance the mathematical skills of students.

114 Calculus Connections: the use of evaluator instructors

Robert Harding (Department of Applied Mathematics and Theoretical Physics, University of Cambridge) and D A Quinney (Department of Mathematics, Keele University)

Calculus Connections is a joint project between ourselves and two US organisations, the publisher J Wiley and Sons, and the software house Intellipro Inc. Calculus Connections is a 3 volume CD-ROM multimedia package for PC/Windows, with 8 modules plus a Laboratory Manual for each volume, and it is designed to complement and enhance any existing calculus course. It is not intended as a replacement, but rather as enrichment material, and can be used with either *traditional* or *reform* oriented calculus texts (in US terms).

Each module of Calculus Connections is built around two *real life* applications which are first presented to the student using multimedia technology. These are followed by key mathematical concepts, and a number of interactive exercises. A high level of interaction encourages the student to investigate the nature of mathematical models, and explore their relationship with the real world. The material is usually studied in that order, but the student can access any part of the package at will. Other resources include a 3-D graph plotter, glossary, mathematical biographies, online help about

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using the package, and links to computer algebra packages. There is an accompanying Laboratory manual; this combination allows course instructors a great deal of freedom to exploit Calculus Connections to best advantage for their own students.

The experience of the Calculus Connections project is relevant to the conference theme of dissemination because the project was organised and managed from the outset with the aim of reaching a wide audience. We have drawn on past experience in such areas as courseware design, course structure, and the problem of integrating courseware into the curriculum.

It is important to be effective in these areas, but alone that is insufficient to achieve widespread take-up . The project's approach is to use a panel of six evaluator instructors, drawn from potential users. Their reviews have shaped the package greatly. Volume 1 was published in August 1995, and evidence from the first six months' sales suggests that the project's overall strategy is succeeding.

Group 12 EVALUATION

122 Integrative evaluation as an agent for change

Margaret Brown (TILT Evaluation Group, University of Glasgow)

During 1993-1995 the Evaluation Group of the TILT Project in Glasgow University developed methods for evaluating Computer Assisted Learning (CAL) materials used in a wide variety of departments in the University. Evaluations using these methods ranged from single episode field trials to the evaluation of CAL material in use in a full degree course over 2-3 years.

Our evaluation strategy involves studying students for whom the courseware was intended in the situation in which it is and will be used. Only by doing this do we consider that it is possible to determine whether it will be considered a useful learning resource and how its value to students and staff can be improved by ensuring it is fully integrated into a course.

Evaluation is not an end in itself. What is important is what occurs as a result of an evaluation. This paper describes some of the conclusions reached by the Evaluation Group that resulted in changes being made by teachers in the delivery of CAL and other resources to students, and we consider improved the integration of these resources into the courses.

These evaluations and the subsequent changes introduced have influenced our thinking on the integration of CAL and other resources into courses in the future. The evaluations have also changed the teachers' view of the evaluation process itself as they now identify its value not only in improving the integration of courseware, but also in Course Review and Quality Assessment procedures.

178 Is interacting with computers interaction with knowledge?

Andrew Ravenscroft and Kenneth Tait (Computer Based Learning Unit, University of Leeds), Ian Hughes (Department of Pharmacology, University of Leeds)

Recent initiatives (eg the Teaching and Learning Technology Programme) have produced a considerable amount of computer based learning resources that are currently being introduced into curricula. However, their true pedagogic impact is unclear at the moment. To exploit computer based resources we have developed an Integrated Learning Support (ILS) toolkit (Ravenscroft, Tait & Hughes, 1996) that produces sibling systems which integrate a range of computer based knowledge media (eg tutorial packages, simulations, electronic documents) into curricula.

During evaluations (Ravenscroft, Tait & Hughes, 1996) of three exemplar Pharmacology Integrated Learning Support (PILS) systems we noted that, as a learning aid, electronic documents that included lecture summaries and lecturers notes in a word processed format were rated higher than interactive Computer Based Learning (CBL) packages (typically tutorial packages and simulations). When questioned (during interviews with focus groups), students did not understand how the CBL packages could integrate with their current learning strategies or profitably support new ones. Students tended to adapt, in a piecemeal fashion, existing strategies to integrate computer based resources such as electronic documents. For example, they would browse them online, preview and edit them online before a lecture, annotate hard-copies during lectures, and compile a hard-copy work-book that could be rewritten for revision. In short, the electronic documents afforded integration with off-line learning strategies. Whereas the CBL packages were used for little interactive online learning and did not integrate with off-line learning strategies.

It appears the notion of interactivity stretches way beyond the computer screen to non-computer based learning environments. Interactivity online may not be as pedagogically powerful as interactivity in the wider sense, in terms of the way students interact with knowledge; manipulating, constructing and reflecting on it both on and off line. The computer is a recent introduction within a more extensive learning environment in which students learning strategies are already situated (Seely-Brown, Collins & Daguid; 1989). Thus, the design of the computer based materials must afford improved interaction with knowledge and integration with non-computer based learning strategies, and to support this, tutors need to provide instruction about how the new media are used to improve learning.

Group 13 EVALUATION

118 A systems analysis and design approach to the integration of learning technology into teaching

Greg Stoner (LTDI, Heriot-Watt University, Edinburgh: on secondment from Department of Accounting & Finance, University of Glasgow)

This paper presents an overview of the processes involved in the integration of learning technology into courses which is informed by the systems analysis and design field of information systems research and practice. Methodologies of systems analysis and design are widely discussed in relation to the design and implementation of computer programs and computerised information systems in organisations. The lessons learnt in these disciplines are applied to the implementation of learning technology in order to further our understanding of the learning technology implementation process.

The paper provides overviews of the principle attributes of systems analysis and design and of the systems approach to instructional design. The introduction of learning technology has many similarities with the traditional systems analysis & design process, for example:

- both involve the introduction (or change of) computer based systems;
- both involve people as well as technology;
- both are centred around *change* in what is done.

The significance of these similarities is considered alongside the differences between the corporate environment of traditional organisational information systems research and the learning environment in the higher education sector.

The core of the paper is a proposed life cycle model of learning technology integration that takes into account the interests of systems users - the students and staff - as well as wider organisational and social interests. If applied flexibly and appropriately this framework may enhance the success of learning technology implementation.

The paper concludes with a discussion of the ways in which the life cycle model of learning technology integration might be applied in real teaching situations and some of the lessons that derive from and have influenced the development of the proposed model.

159 Integrating learning, expertise, and organisational structure in technology-based teaching and learning

Gordon Joughin (Faculty of Law, Queensland University of Technology, Australia) and Jenny Winn (Computer Based Education, Queensland University of Technology, Australia)

A recurring theme in the development of technology-based learning is the need to integrate pedagogical and technological dimensions of learning. We have adapted a framework used by Graham Gibbs (1992) to help identify the nature of these dimensions and the way in which they are related to each other. These dimensions have the potential both to describe and inform:

- how effective learning occurs;
- how learning materials can be designed;
- how organisational structures can support or impede the design and development of materials.

With respect to learning, the horizontal axis deals with the type and structure of materials and is concerned with how information is stored and accessed. The expository extreme describes materials that are purely didactic and over which students have little control. The exploratory extreme, on the other hand, represents a rich array of resources at the students' control.

With respect to the varieties of expertise required for developing technology-based education, the horizontal dimension requires expertise in the making of educational *product*, including expertise in programming, interface design, and the use of authoring software. The vertical dimension requires expertise in learning theory and the design of educational experiences that will promote high quality learning outcomes.

With respect to organisational structure, the dimensions indicate the need for organisational structures that facilitate the confluence of the required expertise, skills and resources. Examples of such structures will be considered.

Group 14 EVALUATION

69 Integration of computer technology into a medical undergraduate curriculum: the King's experience

V Aitken and A Lewis (School of Dentistry and Medicine, Kings'College, London)

Kings College London (KCL) has developed an exciting a new medical undergraduate curriculum which prepares students for the 21st century. A variety of active learning techniques are utilised to produce a deep approach to learning with the emphasis on knowledge, attitudes and skills. In particular, integration of academic and clinical studies to allow the students to have worthwhile experience from the first weeks and to ensure that clinical placements pose an intellectual challenge.

The course aims to take advantage of new technologies to supplement and enhance traditional methods of learning. To aid integration it is proposed that all students joining the new course will be offered notebook computers for coursework and to link via modems to the main network. SuperJANET will be utilised to allow the students on community placements to keep in contact with the school via email and to have timetables, study guides, syllabi and lecture notes made available. Further, students will be able to access online services via the library from remote locations. Multimedia material will be incorporated to enrich the learning experience. This material ranges from basic textual material to interactive material. Interactive tutorials will provide a student-centred environment which encourages an exploratory style of learning particularly when problem based learning techniques are employed. The use of such interactive tutorials allows the students to practice their ability to evaluate evidence presented by the patient, analyse the problem posed and offer a solution.

This paper reviews the experience of KCL as it prepares to launch its new curriculum with particular emphasis on the integration of computer technology into the curriculum.

93 Approaches to the implementation of learning technology in biology, business studies and humanities

Stan Zakrzewski and Joanna Bull (Unit for Learning Technology, Research and Assessment, University of Luton)

This session will examine the practicalities of implementing learning technology in three disciplines. The University of Luton, has recently introduced learning technology materials in the departments of: Biology, Business and Economics and Humanities. This session discusses the implementation strategies used in each department and evaluates their relative success. Suggestions and guidelines concerning the implementation of learning technology will be made.

The University of Luton aims to use learning technology as effectively as possible to enable more flexible, open and student-centred learning throughout the institution. As a pilot for more widescale introduction of learning technology materials, it was decided to introduce appropriate materials within three departments, in three different faculties. This would be used to assess student, staff, departmental and institutional needs for the successful implementation of learning technology.

Each of the departments was selected to be involved in the pilot project for different reasons. In the Department of Biology academic staff were enthusiastic and already involved in the use of some learning technology. In the Department of Business and Economics the software chosen was applicable in a wide range of subject areas and would be portable outside the department. The Faculty of Humanities was chosen for software reasons - the package to be used was a generic shell which could be modified, updated and specific content related material entered.

The session sets out to achieve the following objectives:

- to examine how these materials are used in teaching within the three different disciplines, focusing on the different approaches taken and their merits and disadvantages;
- to examine the technical and operational issues and considerations of implementing learning technology;
- to examine how the use of learning technology affected the student learning experience and consider issues of staff development;
- to provide suggestions for guidelines for the implementation of learning technology.

Group 15 CASE STUDIES

23

Electronic questionnaires: using the Internet and World Wide Web to conduct CAL research

Philip Barker, Karim Manji and Check Meng Tan (School of Computing and Mathematics, University of Teesside)

Research into computer assisted learning (CAL) often takes the form of trying to identify good practice (and the factors that underlie this), measuring people's attitudes and abilities and/or attempting to evaluate a software/hardware package in order to assess its strengths and weaknesses. The conventional approach to conducting these types of research is usually based on the use of questionnaire methods. In the past, these activities have usually been based upon the use of paper as a distribution and recording medium. The widespread availability of the Internet and World Wide Web (WWW) now makes it possible to use many new approaches to assessing attitudes and evaluating courseware products. For example, through the use of list-servers it is possible to conduct evaluations using much larger groups of subjects from many different organisations. Of course, it is also possible to create *dynamic* questionnaires that respond interactively to the responses that a subject enters. Because of the many attractive features that they offer, we have been exploring the potential utility of these electronic techniques for conducting survey analysis and courseware evaluation. The methods that we have been employing are illustrated by means of two case studies.

The first case study illustrates the use of *email* methods to deliver electronic questionnaires based upon the use of either simple ASCII text or more sophisticated documents that are created using a wordprocessing system. Two examples are used to illustrate some of the problems that arise using these techniques and how *logic* that is embedded in a questionnaire can tailor its delivery and ensure its completion.

The second case study is used to illustrate how an electronic questionnaire can be mounted on a WWW server for people to fill in using a suitable Web browser. On completion of the questionnaire the results are sent back to the server for processing using appropriately designed items of software. This approach is attractive since it allows total automation of the data analysis and presentation procedures.

In the final paper each of the above two approaches will be described and the advantages and disadvantages discussed.

206

Rich environments for active learning in the real world: a computer-based solution?

Stephen Bostock (Department of Computer Science, Keele University)

A constructivist view of learning suggests the creation of Rich Environments for Active Learning (REALs). Can this theory be implemented in mass higher education? How can REALs be created with high student/staff ratios and typical constraints? A possible solution is computer based learning and this case study describes an implementation. In 1996 a one-semester course for 285 undergraduates was designed from constructivist principles within constraints of timetable and resources, and then taught by the author through a mix of media. The learning environment included World Wide Web pages for instruction and as resources, Web forms, electronic mail, a local Usenet group, a bespoke CBL package and a collection of videos. There were no lectures, tutorials or paper. Student assessment was by a student diary and a project report, with no examination. The evaluation methods included Web forms completed by students, interviews and assessed learning. The evaluation assesses the success of the mix of media in creating a REAL and, more generally, the possibilities for computer mediation of Rich Environments in mass higher education.

Group 16 CASE STUDIES

117 Enriched distance learning and independent study: developing the means to support an innovative learning programme in higher education through video conferencing and the provision of online resources through the Internet.

Elizabeth Foster and Sam Saunders (Work-based Learning Project, University of Leeds)

The Leeds University Work-based Learning Project has been a partnership between The University of Leeds, Elida Fabergé of Seacroft Leeds and the Henry Moore Institute, in consultation with Higher Education for Capability and the City and Guilds of London Institute. It has been sponsored by the Department for Education and Employment and by Leeds Training and Enterprise Council. The primary aim of the project has been to make it possible for people at work to undertake work-focused projects that lead to personal and company development while benefiting from University expertise and knowledge. Registration and assessment procedures and criteria have been developed that enable these projects to be submitted for University awards at undergraduate and postgraduate levels.

Each project is defined in a series of negotiated Learning Contracts and each work-based learner is supported by a tutor, a workplace mentor and by fellow work-based learners. The resources of work and of the University are negotiated parts of the learning support.

From the University point of view, this project has required innovation on all fronts. An early decision to collaborate with the University of Leeds Virtual Science Park (sponsored in this work by Leeds TEC) has made it possible to investigate the simultaneous use of videoconferencing and shared applications in off-campus supervision meetings between tutors and students. This has addressed the need to provide enriched distance learning opportunities into a potentially *expensive* learning environment.

Alongside this experiment, the project has been developing the means to make its broad approach to independent study available through the Internet.

Our paper describes the way in which these technologies have been built into the project and what the principal benefits and problems have been. Issues for further exploration are raised.

237 The *re-skilling* of a distance teacher: the staff developer's role and a practitioner's experience

Shirley Richardson and Jean Wood (Monash University, Australia)

The model of distance education practised at Gippsland prior to 1991 was unique in its distinguishing characteristics: attendance at four Weekend Schools each semester was expected and there was unlimited access to lecturers by phone. This *extended classroom* model was seriously impacted by the *massification* of Gippsland's distance education program. In its incorporation into Monash University, Gippsland shifted from being a regional provider to being a national and international provider of distance education. Its Distance Education Centre at Gippsland supports faculty at three other Monash campuses in externalising their courses, and it has been the *engine* of Monash's venture into Open Learning.

In this *massification* process Weekend Schools became marginalised. No other Monash campus has chosen to include them in its distance program. From the outset, fee for tutorial service has been one of the distinguishing characteristics of the Open Learning initiative. The importance of providing opportunities for teacher-learner and learner interactions in distance programs was in danger of being forgotten.

The paper will present one practitioner's involvement in an ongoing action research project which, when viewed from a *political* perspective, can be said to be reclaiming shared control of the teaching and learning process for distance teachers and learners through the use of computer-mediated communication (CMC) technologies. It will outline a cautious, staged introduction of these technologies into the teaching of the Economics major of the BBus undergraduate degree. Firmly grounded in an iterative process of praxis and reflection, participation in three extended online professional development activities over two years preceded a first *experiment* in Semester 2 1995 with third-year on-campus students of an elective Business Ethics subject.

In Semester 1 1996 lessons learned from this first *experiment* informed the introduction of CMC into core entry-level Economics subjects for two cohorts of student volunteers, one attending the home campus, one attending a remote campus. The next stage - Semester 1 1997 - must be to widen participation to involve all students in the Economics major who are truly *distant*.

Group 17 CASE STUDIES

33

Introducing computer mediated communication into a women's studies course

Gill Kirkup (Institute of Educational Technology, The Open University)

Gender differences in access and attitude to information and communication technologies (ICTs) have been well reported. Despite this, ways must be found to use the technology to the benefit of women students, especially in distance teaching where ICTs are being widely developed to support learning.

At the start of the 1996 year all students (322) and tutors (19) of the Open University's (OU) undergraduate interdisciplinary Women's Studies course were offered, free of charge, CMC software and access to an exclusive Women's Studies electronic conference.

Although part of the Women's Studies course examines gender issues in science and technology, the course content is very much in the social science and humanities domain. Students were unlikely (roughly 5%) to have previously studied OU courses in the technology, maths or science area. Students on the course had a wide experience of only a very limited aspect of ICTs : word processing. In terms of access or experience this course did not look like an ideal vehicle for introducing CMC. On the other hand students on the course were keen to find out more about the new technologies. On previous years at the course residential summer school enthusiastic groups of students attended introductory practical sessions accessing the Internet and Web sites. Previous research by the author (Kirkup and von Prummer) had also shown that women studying distance education courses had a much greater desire than male students to make contact with other students. Using CMC on a Women's Studies course for just this purpose could particularly enriching for the students involved.

By early March 1996 35 students and 5 tutors had requested software to join the conference. The rest reported no access to suitable equipment. This paper will report the ways these Women's Studies students used CMC during the year and put this in the context of wider work on gender and ICTs in education, in particular in open and distance learning.

60

Crossing the epistemological divide? How gender mediates the experiences of information technology use in a humanities course

Vanda Corrigan (School of Historical, Philosophical & Contemporary Studies, University of North London)

The perceived epistemological and cultural divide between science and humanities and the association of computers with the former, has a bearing on the use of IT as a Learning Technology in the Humanities.

The self-identity of humanities students as possessing characteristics which make them distinct from science students, may produce conflict/self doubt when those students are required to use computers - an action which perceptually crosses the humanities/science divide. As both the image of the culture surrounding computers and the logical thought associated with them is seen as masculine, conflict can also arise (or be compounded) in relation to a student's gendered sense of self.

Much previous research concerning gender differences in computer-related behaviour/attitudes has been carried out, but mainly in the context of science-identified subjects. This research explores the experiences of a group of humanities students opting for a joint/minor degree in Information Technology, a course which I see as bridging the gendered epistemological divide. Case study data have been collected via classroom observation, a series of interviews, informal conversations and the discussion and observation of students' course work in progress (hypertext authoring). The gender profiles of the case studies and other groups of students were also assessed using the BSRI.

This paper will report on the findings of this study, and explore the factors which affected these students' changing experiences with computers. It will include discussions of the interplay between a student's gender identity and the gendered positioning of subject, computer technology, cognitive style etc, and the possible role of hypertext authoring in enabling students to cross these epistemological and cultural boundaries. The wider implications for the use of IT as a Learning Technology will be addressed.

Group 18 TEACHING & LEARNING

76 The effectiveness and limitations of language learning advising in open and distance learning

Marina Mozzon-McPherson (University of Hull)

This paper intends to show how the appropriate and effective use of technology (such as computer mediated conferencing) can enhance professional skills and widen access to resources and assistance.

The author has developed an online needs analysis database which allows the systematic monitoring of students' progress and university language needs. As a result of that new language courses have started as well as regular learner training sessions, targeting the needs of the learners.

The use of computer conferencing and email are two additional key elements in such a monitoring of self-study programmes. Online tandem learning and tandem teaching have also raised awareness in staff and students on the effective use of language software in learning and teaching.

The author wishes to demonstrate that unless there is a clear institution strategy/ policy on the creation of a new learning environment, no ethos can be created and each new development remains an isolated case with very little repercussion within the University environment.

226 The integration of technology into the language curriculum: the staff development aspect

Brigitte Dold (Department of German, University of Greenwich)

This paper begins with a brief description of the rationale for the use of, and the development and implementation of CALL (Computer Assisted Language Learning) facilities at the University of Greenwich in general and in the Language Centre in particular. It aims to answer the question *"What role can the computer play in a subject whose primary objective is real-life communication?"*.

I will explain how we dealt with the question of software acquisition when the Open Learning/Self Access Language Centre was set up: was it better to acquire dedicated software and integrate this into the language programme or to purchase authoring packages which allow the tutors to develop tailor-made activities for specific groups or levels of language learners?

I will show how we fared as a result of our decisions and demonstrate ways of integrating different types of computer-based activities into the language teaching and learning process.

I will also describe the necessary staff training activities we organised in order to introduce colleagues to the new language learning opportunities and to overcome possible technophobic reactions to the new media.

I will argue that, based on our experiences, the notion of the language teacher being supported by technology is only possible if the teacher knows and controls the technology, not the other way round. Contrary to many language teachers' fears of being replaced by machines, I will further argue that Self Access and the use of computers is not a question of saving money in this way. If we want the language learner to perceive computer-based activities as useful for the acquisition of language skills, then the teacher has to play an important part in the development and organisation of these activities.

Group 19 INSTITUTIONAL STRATEGIES

250 What use has Oxford for learning technology?

Jonathan Darby (University of Oxford)

Oxford is a very traditional university and it is highly decentralised. Each college is an autonomous learning institution and the departments, where they exist, act in a similar manner. The concept of an institutional strategy takes on a rather curious meaning in the Oxford context since the university is in effect a loose federation of powerful states. The top-down approach to promoting innovation, applied to such good effect elsewhere is a non-starter at Oxford, so is Oxford capable of using learning technology to good effect?

The presenter has just been appointed as Director of Technology-Assisted Lifelong Learning at Oxford University so he has to believe that change is possible. He will share ideas on how Oxford's singular situation can be turned to advantage and will also unashamedly look to the session participants for help in his new role.

256 Building an institutional information environment - the Glasgow case

Peter Kemp (Academic Services, University of Glasgow), Adrian Bowman (Department of Statistics, University of Glasgow) and Rick Trainor (Vice-Principal, University of Glasgow)

The development of a supportive environment within which the use of innovative teaching and learning techniques can be fully exploited right across the curriculum requires a series of effective partnerships.

One is between senior management, responsible for both direction setting and resource allocation, academics developing innovative teaching and learning methods and the information service providers who ensure a rich and functional environment. An effective partnership here will go far to provide an environment in which students can learn effectively.

Another is between those responsible for the management of different types of information - associated with teaching, research and administration - since the synergy developed will help to ensure that developments which may appear infeasible from a single viewpoint become cost-effective when viewed in an overall context.

Finally, we need to develop partnerships with others working in similar fields in other institutions; no one institution has all the answers and, in any case, many developments require the size of user-base only available on a national basis.

This presentation will use recent and planned developments in the University of Glasgow as a case study for the introduction of effective information systems to support all the activities of a major university.

The authors represent the various strands of the partnerships indicated above, being a Vice-Principal, an active academic and the Head of Academic Services. In addition, two authors are Directors of CTI Centres active in national collaboration. The presentation will make reference to both successes and difficulties, and emphasise policy and managerial aspects of innovations in exploiting information technology. Possible tensions between computing and library services, and between academic and administrative support will be discussed. Particular emphasis will be placed on how teaching, learning and research are best served by a campus-wide collaborative approach, including participation in national initiatives as well as locally-inspired developments.

WEDNESDAY 18 SEPTEMBER 0900-1045

Group 19 DISSEMINATION

10

Using the internet as an enabling technology to promote learning

Brian Sloan (Department of Building and Surveying, Napier University)

The Internet is a communications network which is beginning to impinge upon the educational process at both undergraduate and postgraduate levels.

As an enabling technology it brings to the educational process a freedom to explore knowledge and to experience new horizons in the sharing of expertise. However, its use should be encouraged only where it adds value to the educational experience and not because it is the latest technology.

The paper will consider the potential for the Internet and, in particular, the World Wide Web (WWW) to be used by academic institutions to share expertise. The potential is such that individual lecturers and institutions no longer need to possess all the necessary knowledge for programmes of study but can collaborate in sharing knowledge. In addition, it is possible using available technology to offer joint courses at undergraduate and postgraduate levels across the WWW.

The paper will outline the opportunities which exist for the use of the WWW to share knowledge and expertise across national and international boundaries. Illustrations will be given of work being undertaken within Napier University, together with other examples from around the world. The paper will put forward the hypothesis that the WWW offers exciting opportunities for collaborative sharing of information worldwide. However, this potential can only be realised if educational establishments allocate resources for the purpose. The enthusiasm of individual staff members may achieve much, but corporate responsibility for quality of provision for undergraduate and postgraduate students necessitates a radical rethink as to why Computer Assisted Learning (CAL) is being adopted. Cost saving is often the main reason why educational establishments seek to capitalise upon the use of IT as a learning resource. However, the adoption of CAL as a learning environment carries with it distinct development and training costs which must be seen as part of any investment.

13

Flexible access to electronic learning: potential applications of hand-held computers as CAL delivery platforms

Philip Barker (School of Computing and Mathematics, University of Teesside)

With the widespread availability of information technology, the concept of *Education on Demand* is one which will have important implications for the development of electronic learning and training resources - and their subsequent distribution over any future *Information Superhighway*. Using such an approach will probably guarantee that these resources will be readily available in universities, colleges and schools. However, it is also important to ensure that they are also accessible from within home, office, business and industrial environments.

In other words, computer-based learning and training materials should always be easy to access from any location where there is a potential need for them. An important technique for the realisation of this requirement is the use of *just-in-time* delivery strategies.

This implies that learning and training resources must be made globally available to users as and when they are required at dynamically determined points of need. Bearing this in mind, it is important to consider the types of computing and communications resources that are available to support this technique. Two obvious types of resource for facilitating flexible access to electronic learning and training resources are notebook and palm-top computers. Increasingly, palm-top (or hand-held) computers are playing an important role as *personal digital assistants* or PDAs. Usually, such systems provide the full functional characteristics of a desk-top computer. As well as helping to organise, access and process personal information collections, a PDA is able to provide a mobile computing facility and a powerful communications resource. In addition, they are also able to provide a highly portable, individualised and readily available learning environment that, if necessary, is capable of supporting collaborative learning at a distance.

Because of the growing importance of the types of facility outlined above, this paper will describe and discuss potential pedagogic applications of a typical palm-top computer system - the Psion 3a. It will outline the type of learning environments that this type of system allows its users to create. These are based upon the use of:

- its mobile communications facilities;
- easy access to electronic publications (such as journals, papers and books) that are published on solid-state discs;
- various types of courseware that involve simulations and games;
- and access to the World Wide Web.

A case study illustrating the use of multimedia electronic books published on solid-state discs and the Internet will be briefly described.

183 Providing virtual access to higher education: the University of Ulster ACTOR project

Gerry McAleavy, Gerard Parr and Stephen McAlister (ACTOR Project, University of Ulster)

The paper will address the Applications for ISDN Communications Technologies to Extend OutReach (ACTOR) Project which is designed to make use of Advanced Telecommunications systems and services to address the challenges of extended access to the university's courses and to assist with the transfer of technology to business in Northern Ireland.

The project has been targetted at client groups such as women in rural areas, post-16 trainers, teachers converting to technology teaching, staff in employment in the computer software industry and other training providers.

The paper would address how the ACTOR project is directed at the need to improve both standards of education and training and to ensure that the education system is contributing to the development of the local economy.

To date the ACTOR project has successfully extended University of Ulster outreach to many organisations from both education and commerce within Northern Ireland and beyond.

The paper will address how it is clear that programmes designed to improve education and training have to be delivered in a flexible manner if equity in educational provision is to be achieved. This is particularly important in the context of the increasing demand for education from mature students, persons who are retraining and the need to raise standards across communities that have experienced disadvantage.

There is, therefore, a clear need to address both the needs of individuals and the requirements of a modern economy by the application of new methodologies of learning designed to enhance access and raise standards.

In order to deal with these deep-seated concerns it will be shown that consideration should be given to determining the optimal ways in which the new communications technologies could be utilised to assist the development of flexible learning systems and, in particular, to share scarce expertise and resources across the further and higher education sector.

Group 20 EVALUATION

74 The use and evaluation of CAL at home

Ann Jones, Canan Tosunoglu, Eileen Scanlon and Philip Butcher (Institute of Educational Technology, The Open University)

Due to a recent expansion in Higher Education in the UK, universities are considering new ways of teaching large numbers of students, and in particular, how the use of new technologies might help. Many universities have become *dual mode*: in addition to their full time undergraduates they have part time students, who spend much of their study time working from home.

This has led to an increased interest in the development of materials that students can use when working without a human teacher present (often using new technologies). Students at the UK Open University (OU) study part time for their degrees, based at home. We have a particular interest, therefore, in the use and evaluation of home based resources, and the project reported on in this paper is concerned with Computer Assisted Learning (CAL). Using computer based stand alone materials raises a number of issues, however: for example, the speed of technological change means that packages soon appear dated. There are also evaluation questions of how to assess learning materials which students use at home. Despite the current interest in CAL because of its potential help in teaching an expanded student population, there is little empirical data about students' home use of CAL.

This paper will consider these issues and discuss some of the methods that the OU uses to evaluate students' home use of CAL. These will be illustrated with an example of a study of students' use and perceptions of CAL packages which have been in use in the university for some years (and are therefore an example of old fashioned software), but only recently available for students to use at home. The results of this study support our argument that if they are pedagogically sound, and students find them useful, they have a longer life than we might imagine.

80 Future directions for CAL evaluation

Cathy Gunn (Centre for Professional Development, University of Auckland)

Traditional research methods have proved increasingly difficult to implement and often lack the capacity to produce meaningful results when evaluating the impact of CAL on teaching and learning. The rigid nature of experimental design restricts both the scope of investigations and the conditions in which studies can be conducted. It has also consistently failed to identify all influences on learning. In innovative CAL environments, these influences are many, and it is important for researchers to investigate them.

Over the past four years, an evaluation framework has been developed specifically for CAL research. Two important factors differentiate this work from traditional evaluation practice. Firstly, the importance of conducting evaluations in authentic contexts is taken to mean that studies should include assessment of the contribution of supporting resources which, together with CAL, form a productive learning environment. This is conceptually opposed to the experimental principle of isolating the effects of CAL for measurement purposes. Secondly, evaluation is based on qualitative, case based research which focuses on fine levels of detail. Case study reports provide highly relevant feedback on the situations in focus and also offer guidelines for evaluations in different learning contexts. Findings can be used to inform the design of quantitative studies if these are considered necessary.

Some major advantages have resulted from this approach to evaluation. The easy satisfaction of practical and situation specific requirements is one immediate benefit. Relatively low cost is another important issue which was an initial driving force behind development of an alternative methodology. Although there is little scope to produce generalisable results in the short term, the difficulty of doing so in experimental studies suggests that this is an objective that is rarely achievable in educational research. Further support for the approach is drawn from current literature describing the problems and experiences of practising CAL researchers.

143 How good is our CAL?

Kirsty Davidson (Mathematics Department, Napier University)

The drive for greater participation in education of the 16 to 18 year olds, combined with the current economic climate mean that more efficient and effective ways of training our young people are constantly being sought. Recent rapid advances in technology and the proliferation of high level authoring packages has increased the potential for creating computer based learning software, which is seen as one means of achieving this. Use of such software might allow greater flexibility in delivery and the ability to cope with larger student numbers, but how effective is it?

This paper reports on an evaluation of multimedia courseware on introductory statistics, which is currently under development at Napier University. The basis for the courseware is a quantitative methods II module, taught to about 500 students a year, mainly in the Business School. In semester one of 1995/96, an experiment was carried out with two groups of 150 students actually taking the module. The students were divided into the two groups according to the previous performance in this subject, of students on the same courses in the past. One group of students were taught in the traditional way with three hours of class contact time; the other group had two hours of class contact time and one hour in a lab using the multimedia courseware. They were then assessed on that part of the course, by means of a test which contributed to their final module mark. The mean test mark for those students who had used the courseware was significantly higher than for those who had been taught by traditional methods. Results from a questionnaire, asking the students for their views on aspects of the software, were also very positive.

Group 21 EVALUATION

41

Two-way interactive satellite tuition: lessons learned from recent Open University (UK) experiences

Anne Jelfs and Rosie Thomson (Institute of Educational Technology, The Open University)

Recent years have seen a move by the Open University from second to third generation distance learning systems, with satellite technology forming part of this move. There has also been a change in the use of satellite television transmissions from delivering television programmes, to interactive transmissions.

This research looks at experiments in the Open University in the use of interactive satellite transmissions to reach students in mainland Europe. These experiments have been fully evaluated since it is only through full, systematic evaluation that systems can be improved to the benefit of students. The Open University's recent use of satellite tuition has led to our conclusions and recommendations for change.

The current research looks at different projects, one where the interaction is two-way satellite tuition, the other is one way satellite output and telephone audio return. The two types of format fulfil two different academic objectives.

The first (two-way visual interactive tutorials) was aimed to expand local face to face group tuition, a key feature of OU teaching. The second which followed an information and questions and answers format, was aimed at allaying students' fears and reducing the feeling of isolation in their experience of distance education. Detailed evaluation examined students' satisfaction with both these models.

The research also looks at the tutors' experience from the planning, rehearsal and performance stages to those of peer pressures and scrutiny of their tutoring styles.

The conclusions drawn from the evaluations and research indicate that the use of interactive transmissions has been beneficial for all those concerned, and some surprising effects were noted with respect to operating in such a public domain.

Together with the paper, video sequences will be provided to give a flavour of the types of transmissions.

The conclusions assist in addressing the questions of which formats of interactive satellite teaching are best suited to match different educational objectives and how this medium can best facilitate tutor and student interaction and support.

185

The impact of computer mediated communication (CMC) on adult, distance learners

Malcolm Ryan, Maude Gould and Tony Lewis (University of Greenwich)

The importance of quality group interaction, opportunities for collaboration and their effects upon face-to-face teaching and learning are well documented. Distance learners, however, experience feelings of isolation, perceived lack of support and difficulties in networking with other students effectively.

While traditional modes of communication such as the telephone, mail and fax may help support the individual distance learner, they are not able to address the absence of interaction with peers.

New technologies are able to address these problems, and much current research into the use of computer-mediated communications and telecommunications media suggest that they may effectively establish good quality interaction through the medium of the virtual classroom.

At the University of Greenwich we have used relatively low-cost communications technology in the form of Lotus Notes to begin to explore its potential as a curriculum support tool.

Initial evaluation by the students using CMC in support of their studies indicates that the nature and quality of interaction with their tutors was warm, friendly and supportive with easy access and speedy response times.

Commenting on the impact on their learning they felt that CMC had reduced feelings of isolation, facilitated collaboration through discussion and the interchange of ideas and experiences, and helped to foster the dynamic of belonging to a virtual group.

CMC is not a new tool but this paper explores its impact on adult, distance learners engaged with In-service, Post Compulsory Teacher Education. The use of CMC to facilitate interactivity and collaboration is discussed whilst the benefits to these adult, distance learners and a strategy for its further implementation are considered. The concept of the virtual classroom is explored in relation to the role of CMC as a curriculum support tool.

245 The potential of interactive distance technologies in higher education

Fraser Lovie and Alasdair Mclean (Department of Politics and International Relations, University of Aberdeen) and David Newlands (Department of Economics, University of Aberdeen)

This paper seeks to assess the educational and economic advantages and disadvantages of the use of interactive, live teacher distance learning technologies in higher education. It arises from the authors' experience of using audio conferencing to teach an introductory course in the social sciences to access students throughout the Scottish Highlands and Islands. However, while this case study is the particular focus of the research, some attempt is made to generalise for other interactive distance technologies.

The interactive live audio conferencing tutorials have provided the type of support to students missing from traditional correspondence courses. On the other hand, tutors have experienced a number of problems, notably the communication difficulties posed by the absence of eye contact and of body language. The paper also attempts to determine the attitudes of students to distance learning technologies. It reports the results of a survey conducted among two different groups of students: those who have undertaken the distance learning course and those who have done a similar course by conventional teaching on campus. Finally, the paper discusses a number of wider issues relevant to the assessment of distance technologies, including access, cost, the choice of technology and drop out rates.

Group 22 EVALUATION

100 Evaluating multimedia teaching materials for an undergraduate distance learning science course: a three stage plan

Denise Whitelock (Institute of Education & Technology, The Open University)

The Open University has used a variety of teaching materials to tutor its distance learning students; these include written course units, set books, TV and radio broadcasts, and face to face tuition with a local tutor. It has currently undertaken the production of multimedia teaching materials complementing its wide range of computer assisted learning applications. These have been implemented across a wide spectrum of the University courses from the Arts to the Science and Mathematics Faculties. The current role of the multimedia materials (24 in total) for the Science foundation course is in teaching specific topics such as plate tectonics. These materials will be supported by the main course text.

A three stage evaluation plan has been devised for these CAL materials and they are documented as:

Primary formative testing
This aims to evaluate the interface and the development of generic styles of course presentation. An incomplete product is used in the testing phase. The metrics that will be examined are Workspeed, System Usability and Impact.

Secondary formative testing
In this phase of testing the complete package is ready. Subjects work in pairs and the metrics that will be examined are Workspeed, Navigational strategies, System Usability, Group Discourse and subject pre to post test scores, to measure learning gains.

Tertiary formative testing
This testing takes place towards the end of the developmental cycle and aims to test usability and learning experience issues for the student working alone at home. Data

will be obtained using the above metrics, in addition to investigating the relationship between the design features and experiences of the learners working alone.

This paper will discuss the findings from all three phases of the extensive evaluation of the course.

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Managing multimedia: a model for the production of computer-based assessments and multimedia courseware

Paul Bocij (School of Maths & Computing, University of Derby), Andrew Greasley and Richard Kelly (School of Business, University of Derby)

The rapid growth of educational technology in industry and education raises questions concerning the ability of organisations to deal effectively with new learning media. Organisations striving for innovation must also attempt to minimise costs and make effective use of existing resources.

This paper describes a project within the University of Derby aimed at introducing computer-based assessments and multimedia courseware on a large scale. The Business Multimedia Centre (BMC) is a small unit based within the School of Business and the School of Mathematics and Computing. In less than one year, the BMC has developed a complete computer-based assessment system and has provided more than 6,000 individual computer-based assessments, involving three Schools, eight separate courses and more than 2,000 students. The relative success of the BMC is offered as an example of good practice in the management of multimedia software development projects.

A simple method for managing the production of multimedia software and computer-based assessments is suggested. This model draws upon project management concepts, such as key dates, in order to demonstrate an effective method for the development of new software. It is argued that a backwards-chaining approach provides the best way of directing effort, managing resources and achieving milestones. Such an approach can also serve to reduce the impact of common factors attributed to the failure of software projects.

The paper discusses a wide range of organisational issues of relevance to developers. These include:

- the need for task specialisation in order to make the best and most cost-effective use of staff knowledge, experience and aptitudes;
- the need to disseminate information in order to encourage take-up of new teaching and learning methods amongst members of academic staff;
- the influence of organisational and departmental structures upon the unit;
- issues related to decision making, team building and internal communication;
- techniques used to manage the design, construction, implementation and evaluation of multimedia software.

The overall approach recommended by the paper is one of developing general purpose software systems that nevertheless offer sufficient flexibility to meet specialised requirements. This *useful functionality* is seen as being of major importance for educational software developers. It is argued that the introduction of computer-based assessment software provides tangible results rapidly, thus laying the foundation for future courseware development. Such an approach can be used to focus resources effectively, reduce costs, reduce the overall development times associated with the production of courseware, and encourage the take-up of educational technology amongst staff. In addition, the improved quality of the software produced can lead to increased student performance and can enhance the student learning experience.

212

The interaction of learning styles with varying levels of feedback in multimedia presentation

Myint swe Khine (Educational Technology Centre, University of Brunei, Darussalam)

The concept of feedback and its role in instruction has historically received great attention in the instructional design literature. While feedback seems to be crucial to effective instruction, research indicated that this is true only under certain conditions. Some of the findings suggested that the elaboration of feedback did not necessarily increase in test performance. In an attempt to improve learning efficiency and address individual differences, research frequently focused on the relationship between different learner aptitudes and different instructional methods, particularly on the concepts of cognitive styles such as field-dependent-independent (FDI).

Recent developments in multimedia present opportunities and challenges for educators who want to develop effective instructional programs. A study was carried out to investigate the interactive effects between varying levels of feedback amongst students who were field-dependent-independent in a multimedia presentation. This paper describes the findings from the investigation and discusses some of the implications to the design of multimedia instruction.

Group 23 CASE STUDIES

3

CAL drug metabolism courseware in a pharmacology course: a case study

Paul Skett and Gavin McLellan (Institute of Biomedical and Life Sciences, University of Glasgow), Suzanne Cholerton (Department of Pharmacological Sciences, University of Newcastle) and Neil Kitteringham (Department of Pharmacology & Therapeutics, University of Liverpool)

Drug metabolism is a chemically orientated subject involving a great deal of chemical structures, equations and reactions. Previously this subject was taught as a traditional lecture and practical based course. The poor reaction of the students to this course led to a progressive reduction from a 3-week unit to a series of lectures over one week. It was thought, however, that drug metabolism was a vital part of a Pharmacology course and effort was made to find a way to deliver the material in a more student-friendly manner.

Drug metabolism lends itself well to an interactive computer presentation with the reaction sequences animated. Also the concepts of drug metabolism - *Why? How? Where? When?* - are easily presented in this format. We decided, therefore, to develop computer-assisted learning (CAL) courseware in drug metabolism using the Authorware authoring system. The basic requirement of the system is a 386 25MHz PC with 8Mb of RAM and a VGA colour screen running Windows 3.1 or higher. The courseware development has been funded under the Teaching and Learning Technology Program (TLTP) phase 2 as part of the Pharma-CAL-ogy consortium.

The courseware has been used in the University of Glasgow to replace the 5 lectures in drug metabolism given previously as 5 x 3hr self-directed learning (SDL) sessions. The SDL sessions are run on a problem-based learning (PBL) format where the students are given a set of problems (tasks) to perform over 2 weeks and the member of staff in is attendance for the timetabled SDL sessions. Students have access to the computer laboratory outwith these times as required. The students hand in the answers to the tasks set and are assessed on this written material.

The student response to this change has been overwhelmingly positive, although some find the work hard on the eyes and one student was unhappy with computers and found the course difficult for that reason - this student was advised to complete the tasks using the course textbook. Learning outcomes have been assessed and do not differ between the old and new style courses based on results in equivalent examination questions.

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Biodiversity in Nottingham: a case study of the design and delivery of a ten-credit multimedia module

Peter Davies, Timothy Brailsford, S C Scarborough & W J Trewhella (Department of Life Science, University of Nottingham)

In this paper we will describe our experiences of running a second-year undergraduate module that was taught almost entirely by electronic means. The core courseware was developed by the TLTP Biodiversity Consortium. This material was supplemented with course handbooks, as well as a small number of guest lectures given by visiting speakers. Staff-student contact was enhanced by IT, and extensive use was made both of email and an academic conferencing system (Knowledge Tree).

This course was divided into two parts - during the first of these the students learn the core material from the courseware. This is then followed by a multiple choice course test based upon this material. In the second part of the course the students choose their own special topics for more detailed study - this is then followed by an essay-based examination. In addition there is an assessed coursework component which is made up of various group-based and individual tasks.

An important aspect of this course is that the students were told that it was experimental, and their participation was sought in the design and implementation of the course.

235 The use of simulation software to improve the investigative skills of biology students

Paul Chin, Andrew Lawrence and Cris Woolston (Department of Applied Biology, University of Hull)

To make effective use of Information Technology (IT) in teaching there must be a genuine educational need that cannot easily be fulfilled through conventional teaching methods. This need has been identified in a second year module for biology students (Ecosystems and Communities) at the University of Hull. Simlife, a commercially available ecology program has proved a valuable tool in helping students learn about ecosystems. Using Simlife, students can study ecosystems in an open way, enabling them to improve their investigative skills by observation and problem solving, resulting in a greater understanding of the subject.

The implementation model used involved technical support to both staff and students. Both of these are critical for the successful integration of IT into mainstream teaching. It is often the case that a lecturer may be enthusiastic about implementing IT, but is deterred due to lack of technical knowledge or awareness of the available materials. Using this model the lecturer was closely supported in the planning and implementation phases directly, and also received support indirectly through technical help being provided to the students during the teaching sessions.

This is an intensive, and therefore somewhat unusual model, but very successful. A total of 84 students, split into groups of 3, were given a mini-project to be carried out using Simlife over an estimated total of 10 hours during a three-week period.

This time was divided into a one-hour briefing session followed by a further nine hours. Support was on hand from the lecturer and the IT adviser during 3 of the 9 hours. One of five different ecosystem scenarios was allocated to each group.

The students produced a written report based around each group's observations and findings for the scenario given to them. By utilising a feature of security software (Mac Administrator) on each computer it was possible to ascertain how much time each group had spent on the project. The quality of the final reports was higher than normally achieved, and most groups had averaged more hours in direct contact with the simulation than the allotted nine hours.

Group 24 CASE STUDIES

62 Use of spectrum analyser software in education

Scott Larson and Robert Keddie (Department of Electrical and Electronic Engineering, Bell College of Technology)

The paper to be presented will cover the development of spectrum analyser software by the authors at Bell College, for use in the teaching of Digital Signal processing. The package met a requirement for giving students practical experience in spectrum analysis. Conventional spectrum analysers cost £3000 upwards; the use of software methods provided a low cost alternative while adding a variety of additional advantages.

The software has been in use in Bell College for two sessions so far, and is under development to permit it to be marketed to universities and colleges.

The project has won the Beacon Award for educational use information technology, sponsored by the National Council for Educational Technology, and is the subject of research by the authors.

Topics to be covered will include:

- spectrum analysis will be defined for the benefit of a non-engineering audience;
- uses of spectrum analysis in electrical engineering, and applications to other fields, such as physics, geology, medicine, and music;
- university courses where the software could be used;
- hardware requirements and cost;
- our experiences with using the software in a classroom environment;
- future developments.

107 Applying computer aided learning (CAL) strategies in computer aided design (CAD) - a case study of Architecture, Engineering and Construction teaching at the Mackintosh School of Architecture

Ra'Ed QaQish and Raid Hanna (The Mackintosh School of Architecture, University of Glasgow)

CAL in CAD has been a subject of paramount importance, instigating many debates and much research amongst institutions and universities. In architectural education, most schools have recently witnessed a change in the curriculum due to the rapid expansion of CAD teaching and facilities. Also there is a growing consensus for the need to use CAL packages in mass instruction, and as a substitute tutor for individualized learning.

This paper reports on a PhD study which examines the impact of CAL on computer aided design and architectural education where varying techniques and strategies of CAL have not been fully incorporated. It also examines the need for a framework within which the creation of a modular form of applying CAL in CAD to support the curriculum of architecture, can be structured and assessed.

The recent case study attempts to investigate the CAL in AEC (Architecture, Engineering and Construction) software course as part of the third year design studio at MSA. Attempts at this investigation were made by conducting classroom observations and administering questionnaires to students, thus, determining to what extent the AEC learning events were effective in advocating new strategies in CAD.

Variables such as the tutor's competence, level of administration, task related activities, tangibility of the learning materials, tutor's strategies to help with technical problems and motivations, and the minutes of lesson have been examined empirically. The global rating of the CAL events in CAD lessons, the CAL organization and sequence, level of students confidence, rate of students interests, mode of classroom, level of learner performance and the linking of the current event with the overall curriculum, have also been examined and their interdependent relationships explored.

The findings of this report may prove to be helpful to establish future directions in adapting some form of CAL strategies in CAD. The checklist produced and the questionnaire of this case study may be used in the evaluation of different courses in CAD in the curriculum of architecture schools.

231 An evolutionary approach to computer aided learning

Patrick Lysaght and David Robinson (Department of Electrical and Electronic Engineering, University of Strathclyde)

Computer Aided Learning has many apparent advantages. Its development, however, is beset by practical problems. In particular, the time and effort required to produce even small amounts of high quality material is a primary concern. As a result, CAL is becoming a strategic issue in modern education. Management must decide on the extent to which their institutions can afford to commit to the development and deployment of CAL, or for how long they can defer such investment.

They are also required to manage a dynamic and complex cost versus benefits tradeoff. In this paper the authors report on their experience in developing CAL material for undergraduate teaching in electronic engineering. The initial work used the Macromedia Director software package. Even though the project was conducted by staff who are competent users of information technology, the amount of effort required to generate relatively simple CAL material was unacceptable. The extent of the difficulties encountered with this approach prompted a reappraisal of the project.

The reappraisal developed along two main themes. The first of these was to establish a simple model of the current teaching process and to define how and where CAL could be integrated into the different stages of the process. The object was to determine a strategy for developing and deploying CAL incrementally, evolving from relatively simple to more sophisticated use of the technology. Additional objectives were that each stage would yield tangible benefits and that the investment in development effort would be preserved between stages.

A second theme focused on identifying a set of software tools that would provide support for this evolutionary approach to producing CAL material. This analysis resulted in a decision to evaluate the Microsoft Windows 95 operating system and

Office software for generating CAL material. The use of componentware within the Office suite, under the control of Visual Basic, offers an efficient approach to the development of CAL material. The benefits of rapid prototyping based on an essentially object-oriented approach coupled with emerging support for internet integration were important factors in this decision.

The paper presents a balanced analysis of the strengths and weaknesses of the current methodology for CAL development and the strategy for its deployment. The degree to which the goal of implementing CAL efficiently is being achieved and the potential for future work are assessed.

Group 25 ASSESSMENT

49

The management of continuous computer aided assessment

Terry King (Department of Information Science, University of Portsmouth)

During the period 1993-1996, a study has been conducted in the Department of Information Science at the University of Portsmouth to establish the viability of using computer aided assessment (CAA) for the continuous assessment of large groups of students. Interim reports already published (King, 1995) deal with the testing process, and subsequent findings and developments. This paper will detail important conclusions concerning the level of support required at different levels in an institution for a programme of continuous CAA to be effective.

Continuous CAA demands that already busy academics prepare and deliver a sequence of tests, for large groups, within the constraints of an ordinary lecturing environment. Such testing does not benefit from the disproportionate amount of preparation, moderation, support and invigilation time that can be expended on an individual CAA exam. The management of a sequence of CAA tests, perhaps back-to-back, run over an entire semester can place considerable stress on a lecturer, requiring up to sixteen different tasks to be coordinated for each test; including preparation of moderated questions, supporting students in managing the testing process, test delivery, response retrieval and coordination of student feedback.

CAA, if properly managed, can have considerable benefits and each institution needs to establish a clear policy for the promotion of CAA not only through staff development but also through the coordinated purchase of suitable CAA software. Continuous CAA requires additional software features beyond those needed for examinations for maximum flexibility of delivery and adequate student feedback. At a departmental level, extra resourcing is a priority to establish a large bank of well moderated questions. However this case study concluded that the most pressing need was better support from the computer services area of the institution. The paper will detail the problems that can arise in continuous CAA due to poor support from computer services, the tasks currently the responsibility of lecturers which would be better carried out by computer services staff (and vice versa) requiring a relinquishing of control on both sides, and a firm recommendation for a CAA Support Officer role and what that would entail.

150

The Clyde Virtual University assessment engine

Linda Creanor (The Library, University of Glasgow), Niall Sclater (Computer Centre, University of Strathclyde) and Dave Whittington (Computer Science, University of Strathclyde)

The SHEFC funded project, Clyde Virtual University (CVU), is rewriting TLTP and other courseware for delivery using World Wide Web browsers over Glasgow's ClydeNet Metropolitan Area Network.

Formative assessment exercises, with immediate feedback to the students, are a feature of traditionally authored courseware that CVU material will also offer. To this end, CVU has developed an assessment engine that will provide for the authoring, delivery and marking of Web-based assessments. The assessment engine allows for a range of question and for more formal, summative assessments to be carried out.

The question styles currently available are multi-choice and multi-response (with options to have the choices in a fixed order or jumbled up), ordering a list, matching pairs in two lists, gap filling and free text. More question types will be added as and when WWW advancements such as Java become more accepted (and more stable). It is also possible to define a number of possible alternatives for a given question, that way students sitting next to each other in a lab will not be presented by exactly the same set of questions.

The assessment engine is capable of making tests available to a restricted group of students at particular times and from a limited group of computers. The number of attempts a student can make is also controllable, as is the level of feedback. It is possible for the collated results from an assessment to be emailed to the author of the assessment after it has been taken by the students.

The system is divided into three parts. The authoring system allows a member of staff to construct an assessment form from the various question types available and to set any who, when and where restrictions. The assessment generator creates the *fill-out* form from the assessment data. Finally the assessor system marks the submitted form, collates the results for the author and returns any feedback to the student.

This discussion workshop will describe the CVU assessment engine and examine how it can be either integrated with Web-based courseware or used for stand-alone summative assessment.

210 Student assessment across a university campus network

Ian Upton (Information Services, University of Birmingham)

The Student Assessment Facility (SAF) was developed by the Centre for Computer Based Learning (CCBL) at the University of Birmingham in 1993. The facility has been in use for the last three years and has presented several thousand assessments.

SAF enables students to link into a central server and run self assessment or course work tests in their own time. These tests can be run from most of the PC workstations on the university campus. On completion, the student is presented with a mark and feedback. This feedback can point to self help materials if required.

As well as being displayed to the student, results are recorded centrally and automatically compiled into reports. Reports detail statistics such as usage, average time to complete and average scores. Reports also list individual results. Reports are distributed to lecturers commissioning tests.

This paper will introduce SAF and how it is being used. It will include two, very different, case studies; one from the department of French, and one from the department of Earth Sciences.

The paper will then go on to look at how SAF could be developed and will look at issues surrounding the planned expansion of the system following CCBL's merger into the newly formed Information Services.

Group 26 TEACHING AND LEARNING

164 Netmuse: a collaborative, subject-based approach to staff training

Celia Duffy and Stephen Arnold (Department of Music, University of Glasgow)

The innovative MAN-based NetMuse network serves all university Music departments in Scotland. Courseware packages on a range of subject matter are currently under development. These packages are designed to capitalise on the network's capacity to deliver large data files in the form of CD-quality sound files as well as notated scores and graphics. They are being designed and written collaboratively by staff from the participating institutions and authored in HTML by a programming team based in the Music Department of the University of Glasgow.

An important part of the NetMuse project is closely targeted, subject-specific staff training and development activities for academics from all five participating institutions. By making the context and content of these activities precisely relevant to teaching music, we aim to raise awareness of technology-based approaches, encourage our colleagues to use and properly integrate NetMuse materials into courses and generate enthusiasm and demand for more.

The paper will include discussion of issues arising from this venture, particularly the benefits of collaboration for a *minority* subject like music with its highly specialised range of intellectual, creative, technical, skills-based and performance elements. NetMuse can point the way forward for collaborative development and sharing of technology-based teaching materials and towards the benefits of networking - in all senses of the term.

188 Training academics to use networked information: librarians as catalysts of cultural change

Jill Foster (Netskills, University of Newcastle), Jane Core (Edulib, University of Abertay) and Kay Flatten (TAPin, University of Central England)

With increasing student numbers and decreasing library budgets, networked information resources are becoming an increasingly important element in the spectrum of information used by both staff and students in the Higher Education (HE) community. In addition, the number of quality information services on the UK JANET network is increasing as a result of funding initiatives. It is essential that this investment in services is accompanied by a parallel investment in network skills training for users and providers of networked information resources. The Electronic Libraries Programme has a Training and Awareness Stream including two UK-wide projects, Netskills and Edulib, and one regional subject specific testing site, TAPin.

Netskills, based at the University of Newcastle, is building on the results of the Network Training Materials Project and on the Mailbase network training activities for subject groups. Netskills is using a variety of approaches to the widespread diffusion of the network skills required, with use being made of both traditional and network based methods of training. One method of achieving mass training is by helping others to train.

EduLib aims to provide a network of practising librarians, working with institutional agreement, with a programme of generic learning and teaching skills to underpin their educational role. That role may be enacted face to face with learners, in the production of learning materials for independent use, in a one to one situation on a help desk - indeed in any activity where librarians or support staff interact with users.

Once trained the EduLib network of librarians will cascade training onward to colleagues. SEDA (Staff Education and Development Association) is a partner in EduLib and currently provides accreditation for courses for higher education teachers. It is anticipated that the final programme will reflect SEDA objectives and values and may thus provide a model that will offer library and support staff similar opportunity to higher education teachers with whom it is anticipated they will work in ever closer partnerships in the future.

TAPin is a collaborative project based on a consortium of six West Midlands universities. It will take a focused and practical approach involving university subject and systems librarians working with the School of Information Studies at the University of Central England. Librarians in each university were trained via Netskills and Edulib and have developed models for transferring these skills and eLib resources to relevant academic staff in the 1996/97 academic year. A milestone report and impact study will inform the profession of the culture change and lessons learned when implementing outputs from other eLib projects.

This presentation offers an update on all three projects and examines the nature of the eLib programme, including an examination of how the Training and Awareness workshops and support materials will be used to contribute to the overall culture change which underpins the Electronic Libraries Programme (eLib).

234 Staff development for integrating technology into teaching and learning: lessons learnt at Oxford Brookes University

Carole Baume, David Baume and Alan Jenkins (Oxford Centre for Staff and Learning Development, Oxford Brookes University)

Aims of discussion

1 To present the experience of the team in designing, running and evaluating a large-scale staff development programme focused on IT in Teaching and Learning.
2 To facilitate participant's exploration of ways in which they could use the teams experience in working in their own institutions.

How do we engage all staff in a university in the issues of integrating technology into teaching and learning? How do we help staff to develop at their own pace, in ways which are appropriate to their discipline, as they explore the uses of IT in teaching, learning and assessment?

At Oxford Brookes University, during the summer term of 1996, staff development for IT in teaching and learning was targetted in all schools and departments and in various cross-university events. We hosted a two-day showcase of all CTI centres; we involved the TLTP support service in a day on institutional policy; we ran focused workshops on particular topics like IT and assessment and IT and learner guidance; and we funded each school and department to run a programme of staff development events appropriate to their own staff's interests and needs. We even involved our Chancellor, Helen Kennedy, the barrister, in a television-style *Hypothetical* to explore the future of IT for students and staff at Oxford Brookes.

What worked well? What worked less well? What were the lessons we learnt? What are the areas we identified for further action? By the time of the conference we shall have conducted an evaluation of IT Term which we can share with participants. We shall try to run the workshop in a way which allows participants to explore which aspects of our work could be adopted or adapted for their own institutions.

WEDNESDAY 18 SEPTEMBER 0900-1045

112 **Writer's Toolkit: software solution for writing**

Carole Gillespie (Development Manager, Scottish Council for Educational Technology)

Writer's Toolkit was developed by SCET, The Scottish Council for Educational Technology, in conjunction with educators across Scotland to help learners with the process of writing. Extensive research into writing within a realistic educational context played an important part in the design of Writer's Toolkit. Underpinning the package is the concept of writing as a series of crucial stages which must be carried out. The skills of notetaking, structuring writing and drafting and redrafting are central to the program. This developmental approach to writing is applied to all levels and types of writing. The resulting package provides the user with targeted help aimed at imaginative, personal and functional writing. The software can also be customised to provide for the specific needs of users.

Writer's Toolkit is being used throughout the UK, USA and beyond. Users include learners with specific learning difficulties, able learners and students of English as a second language.

The focus of the hands-on workshop will be the importance of the writing process for learners of all ages. The development and design of Writer's Toolkit will be examined, with specific examples of its uses throughout education. The underlying theme will be that the writing process and the problems it creates are the same whether they are encountered by school pupils, undergraduates or professionals writing a report, a research paper or a review. The solutions which Writer's Toolkit provides will be explored.

Specific features of the software and their uses in the writing process will be highlighted. These include text to speech, vocabulary bank construction and the use of self evaluation to improve the skills of the writer.

The workshop will consist of a presentation and demonstration of Writer's Toolkit, with hands-on experience of the software during which participants will compose a selected piece of writing.

126 **Integrative evaluation**

S W Draper and TILT Group E (Department of Psychology, University of Glasgow)

This workshop will introduce participants to some aspects of the method of Integrative Evaluation. Integrative evaluation is a practical approach to measuring the effects of courseware in real use in the classroom. In most real classrooms it is not possible to control factors and compare experimental and control groups to produce a scientifically powerful study. On the other hand (and unlike in most experiments), it is possible to study the conditions in which learning normally takes place and what factors are important. Furthermore it has sometimes led to significant improvements in how the overall teaching (courseware plus other elements) is delivered next time. This approach is integrative in that it examines how the courseware fits into the overall teaching, and how the combination as a whole performs or requires adjusting.

Three activities are planned for the workshop. The first is an exercise on the Resource Questionnaire, where participants will act as subjects and then discuss what significance can be attached to the results from this instrument. It is useful in discovering what learning resources are actually used and valued by students in a given situation: something not necessarily known by teachers in higher education, where learning normally draws on a wide set of resources including students helping each other. The second exercise will concern designing measures of learning gains, applied as pre- and post-tests, with elements of the test (eg quiz questions) corresponding one to one with learning objectives. This has turned out to be powerfully diagnostic of what any modifications to the teaching should be focused on. The simpiest and weakest measure is a confidence log(students' self-estimates of knowledge), the next consists of simple quiz items; more problematic is the design of items to test deep learning. Finally, the workshop will divide into groups who jointly plan an evaluation of either a provided scenario or of cases provided by participants. This will address how the method as a whole fits together, including issues of interacting with the teacher in charge.

172 Supporting flexible learning patterns through the use of computer mediated communications

Christine Steeples and Mark Bryson (Department of Educational Research, Lancaster University)

The aim of this workshop is to share experience of best practice in the use of Computer Mediated Communications (CMC), so that participants are better able to support flexible patterns of teaching and learning. Such flexibility is crucial if we are to maintain quality in teaching and learning in HE, whilst providing a cost-effective response to the needs of an increasingly diverse and growing student population.

CMC tools include email and computer conferencing to allow learner and tutors to engage in learning activities in flexible ways, particularly in terms of timing and location. The workshop will focus on new tools available but examining their use in terms of educational issues rather than from a technological perspective.

The workshop will also examine a number of *success models* drawn from our experience of CMC at Lancaster University and our work on the BT-funded project CMC in HE. The *CMC in HE* project has explored the potential of using CMC with other institutions across the UK HE sector. Details of the project, its activities and findings will be reviewed in the workshop.

The workshop will also include a practical *hands on* session using a computer-based communication system. Participants will be able to explore Lotus Notes software: a highly developed tool for group-based communication and collaborative working/learning. The workshop will then conclude with a plenary session where participants will have the opportunity to:

- explore the issues of access and flexible provision;
- consider their own goals in offering more flexible patterns of learning support;
- examine the kinds of flexibility they are seeking to provide;
- identify how CMC might contribute to more flexible learning support;
- consider how they might customise one or more of the models presented to their own purposes.